SCIENTIFIC AMERICAN

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MEASURING THE TEMPERATURE OF A STAR.—[See page 501.]

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NEW YORK, SATURDAY, JUNE 18th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A STEEL ARCH SUGGESTED FOR THE QUEBEC BRIDGE.

At the time when the plans for the 3,100-foot Hudson River bridge were under discussion, and it was generally accepted that the only type of structure that would lend itself to the then unprecedented span of 3,100 feet was either the cantilever or the suspension bridge, there appeared a remarkable paper by the well-known bridge engineer Max am Ende, in which a design was presented for a steel arch bridge of 3,000-foot span, which was to be erected on the cantilever principle, the load, during erection, being carried by tying it back to suitable shore anchorages until the final keystone was in place. In a recent issue of Engineering News, a similar proposition is made by Charles Worthington, for the construction of an 1,800-foot steel arch at the Quebec Bridge crossing. The elevation of the bridge shows the characteristic beauty of the steel arch. Mr. Worthington is convinced, as the result of his study of the problem, that not only would an arch of this magnitude be practicable, but that in point of cost it would compare favorably with a bridge built on the cantilever or the suspension principle, provided, of course, that suitable abutments could be provided to take the enormous horizontal component of the thrust. This it is proposed to do by constructing a huge concrete strut, or compression member, below ground, extending from the base of the piers to the rock of the river bluffs. Each strut is 20 feet deep and 98 feet in width, and should therefore surely be sufficient for its purpose.

Certainly, the most difficult problem is that of erection; and Mr. Worthington proposes to solve this by the original method of building an erection suspension bridge entirely across the site; and suspending the individual voussoirs, of which the main arch is composed, from the cables, the lower ends of the latter being provided with adjustment devices by which the voussoirs can be held in proper position during erection. The abutting faces of the voussoirs would be accurately machined and provided with flanges by which each section after it was lowered into position would be secured to the erected portion of the arch. The arch consists of four parallel ribs of hollow rectangular section, each 21 feet deep at the crown, 42 feet deep at the skewbacks, and 9 feet wide. When the keystone of the crown had been lowered into place and riveted up, the suspended cables would be slacked up and removed, and the whole suspension bridge taken down, leaving the four great ribs of the arch ready for the erection of the supporting columns and the superstructure of the floor.

The element of doubt which enters into this design is due to the system of erection adopted. It is questionable whether, with the flexible support afforded by the suspension cable, it would be possible to hold the voussoirs with that absolute accuracy and rigidity which is necessary. It is well understood that during erection voussoirs must be kept in exact position by absolutely rigid falsework. Max am Ende was able to secure this rigidity by designing a frame-arch bridge, and tying back the successive sections, as they were added, to rigid anchorages on either shore. Furthermore, because of the great weight of the bridge, whose dead load over the whole 1,800-foot span is estimated at 26,000 tons, the erection suspension bridge would have to be extremely heavy and costly. It is but fair, however, to quote Mr. Worthington as stating that the estimates of the total cost of the structure indicate that it compares very favorably with the cost of a cantilever structure, even if the elaborate erection plant be considered to have no subsequent salvage value.

SIX THOUSAND MILES IN AN AEROPLANE.

It is doubtful if any one, among the many thousands who have witnessed Hamilton's spectacular flights at Mineola, Long Island, and wondered at the bird-like facility with which he performed his evolutions, realized that his success was the outcome of some six thousand miles of actual flying which he had done during the past six months.

In qualifying for the degree of "bird-man," Hamilton has served a long apprenticeship and has traversed the whole gamut of aeronautical experience. Of light but athletic build, quick but cool, and richly endowed with that intelligent daring which is so essential to success in aviation, he has probably had a more varied experience in the air than any other living man. He has been carried up by kites; has not hesitated to cut loose in gliders at dizzy altitudes, and sweep through perilous distances to earth; and with balloons both spherical and dirigible he is altogether familiar. With so much accumulated experience of the "feel of the air" at command, and with his rich endowment of the natural qualities of an aviator, it was inevitable that, when Hamilton took his seat in an aeroplane, he should quickly become one of the most, if not the most, experienced and successful exponents of the new art of human flight. Starting last November with a Curtiss machine, he has spent the intervening months in touring the country and teaching the public to what a pitch of perfection human flight has been carried. Four days a week, for the past six or seven months, he has given exhibitions throughout the country, largely in the West and Southwest, making on each occasion four or five different flights. Hamilton estimates that the total distance that he has flown through the pathless air in the intervening period is approximately six thousand miles, or sufficient to have carried him from New York to San Francisco and back. Just here we should remark that it is fitting that a Hamilton should leave his impress so strongly on the pages of aeronautical history in the United States, since he is a direct descendant from John H. Hamilton, the brother of Alexander Hamilton, John H. being the great-great-grandfather of the present Charles K. Hamilton.

During a recent conversation, and at the request of the Editor of this journal, Hamilton summed up concisely the lessons which he had learned during these six months of day-by-day flying under a wide variety of weather conditions and at far scattered points in the United States.

FLYING IN A WIND.—"To fly in the wind," said Hamilton, "one must practically learn all over again; since the conditions are so widely different from those prevailing in calm weather; but with coolness, judgment, and observation, the problem may be thoroughly mastered. For me, flights in windy weather were frequently an absolute necessity. Large crowds had gathered at race tracks or other open spaces, at so much a head, and, frequently, when the appointed hour arrived, there would be winds of considerable strength prevailing. Many times, and particularly in Arizona, I went up in winds that were blowing from twenty to thirty miles an hour, and over. In Tucson, Arizona, for instance, the government gages showed that on the afternoon of my exhibition, the wind was blowing thirty-three miles an hour. My 8-cylinder, 50-horse-power Curtiss machine was brought out, and held in position facing the wind. As the propeller revolutions increased, the thrust reached a point at which the machine began to lift, and on letting go, the crowd were astonished to see me apparently flying backward. As the motor gained velocity, I first became stationary over the starting point, and then, with full power developed, traveled over the ground at a speed, relatively to the ground, of ten to fifteen miles an hour." On another occasion, at St. Joseph, Missouri, Hamilton rose and gave successful exhibitions in a wind which the local government anemometers registered at thirty-nine miles an hour. The young aviator considers that the bugaboo of the wind has been eliminated, and that from now on the skilled "bird-man" will no longer wait around for three-fourths of a windy day in the hope of making a flight in the remaining fourth. It is not the velocity of the wind, but the sudden changes in the velocity, that constitute the peril. In a gusty twenty-five-mile wind, the velocity will suddenly change, in the puffs, from fifteen to twenty-five miles, a difference of ten miles per hour; and the range of difference increases with the increased speed of the wind.

AUTOMATIC CONTROL.—Asked for his opinion of the value of automatic control, such as might be afforded by pendulum action or by the gyroscope, Hamilton surprised us by affirming that he did not believe in such control. "The pendulum effect would tend to become rhythmical, and the swing might be in the wrong direction at the critical time; on the other hand, the resistance of the gyroscope would be too rigid, and in sudden gusts it might be such as to cause the breaking of the planes by transverse bending strains." When flying in a gusty wind, the sudden upsetting forces must be met and resisted gradually, and the machine brought back to the normal position "with a loose curb" much as a skillful rider will control a spirited and sensitive horse. "The manipulations necessary to right an aeroplane are too complicated and inter-related to be capable of absolutely automatic control," said Hamilton, "as you will see from the following: If a puff hits the right side and lifts it, there are three distinct motions necessary to restore equilibrium. First the wing tips or ailerons must be set to counteract the lifting force; then the front horizontal rudder must be sharply depressed to throw the machine down and gain velocity; and thirdly, the rear vertical rudder must be swung over. These movements must be done with judgment and a delicate touch, and it is difficult for me to understand how the sensitive hand and intelligent mind of the aeronaut could be replaced by purely automatic appliances in a complicated evolution of this kind. Furthermore, for perfect control, there must be a certain amount of anticipation of what is going to happen. Experience teaches the aviator to recognize different atmospheric conditions; he adjusts himself to these and in his manipulation of the control, anticipates the vagaries of the wind. These are conditions which a purely automatic control could never meet."

WING SURFACE AND SPEED.—Hamilton looks for considerable increase in the speed of aeroplanes in the near future, and believes that some of the more powerful machines now being built will have made seventy miles an hour before the close of the present year. As to the far future, the high-speed racing machine will probably be a monoplane, with long, narrow wings, affording small supporting surface relatively to the horse-power. One of the most interesting facts developed during the varied experience of the past six months was the accidental verification of the important principle enunciated by Prof. Langley, that the higher the speed of an aeroplane the less is the necessary sustaining surface. It happened that in adjusting the engine at the commencement of an afternoon exhibition, the intake valves and carbureter caught fire, and several panels of the central covering of the upper and lower planes were burnt out, leaving only 150 out of 250 square feet of surface intact. Rather than disappoint the assembled crowd of 8,000 people, Hamilton determined to try for a flight. Ordinarily, a 100 to 150-foot run would have been sufficient; but in this case it was not until the machine had run over 1,000 feet, and the engine was working at its maximum power, that the machine lifted. Immediately Hamilton discovered that he was flying much faster than he had ever done before; which, of course, was strictly in accordance with the above-mentioned law of flight.

Here is a hint that the racing machine of the future will have some system for reefing, which will allow the sustaining surface to be reduced, and skin friction eliminated as the speed increases. Conversely, when flying at El Paso, in the rarefied air due to an elevation of 3,980 feet, Hamilton found at first that he could not get off the ground at all. The sustaining planes were lengthened, and 135 square feet were added to the normal area of 250 square feet. With this increase, the machine rose, and successful flights were accomplished. As the result of this experience, Hamilton believes that records of high flying in which the machine reaches the rarefied strata of air, should be accepted with considerable caution.

Not very long ago, timber was selected entirely according to its external appearance. The diameter and length of the piece, the straightness of grain, sometimes the weight, sufficed to determine both its commercial value and its destination. At that time, on account of the difficulty of transportation, woods of local origin were almost exclusively employed. It is very different nowadays. With the increase in consumption and the decrease in the local production of wood, it has become necessary to transport timber of every variety and of many places of origin. Furthermore, the diversified industries of the present day require a corresponding diversity in the wood employed. For one purpose, the important quality is hardness; for another, elasticity; for a third, ease of working, or resistance to attack by external agencies. It is evident that very different qualities are required for an umbrella handle, a barrel stave, a billiard cue, a carriage frame, etc. The hand magnifying glass, which was first employed, has ceased to suffice for the exact determination of the structure of wood. The compound microscope is now used for the minute and careful examination of longitudinal and transverse sections of a specimen of timber, the commercial value and the proper industrial employment of which it is desired to determine. Fine-grain and thick-walled cells assure the solidity and resistance which are required in carpentry, and these qualities are incompatible with an abundance of parenchymatous tissue, filled with starch.

ENGINEERING.

There are bills before Congress for raising the Lighthouse Board to the dignity of a government bureau with a single head to manage it. A commissioner will act as executive officer, and it is proposed to place the service in the hands of specially-trained civilians, who will not be liable to withdrawal for active service (as happens with army and navy officers) in case of war.

Referring to our recent article on the six Mallet freight compounds for the Delaware & Hudson Railroad, it is of interest to note that the four frames of the engines, each weighing about 8,000 pounds, are built of vanadium cast steel, having a tensile strength of 80,975 pounds per square inch and an elastic limit per square inch of 45,024 pounds, as determined by tests made while the frames were at the foundry.

A dispatch from Berlin states that the "Von der Tann," the first of the German dreadnought cruisers, reached, on her preliminary trials, a speed of 28 knots. This, if true, places her, in respect of speed, abreast of the British "Invincibles." The latest accounts credit her with carrying eight 11-inch guns disposed in four turrets, one forward, one aft, and two *en echelon* amidships. The displacement is about 19,000 tons.

Figures just compiled by the Pennsylvania Railroad system show that although in 1908 and 1909 its various lines carried a total of 299,762,658 passengers on its 24,000 miles of track, only one passenger was killed as a result of a train wreck. In other words, the chance of a passenger losing his life in an accident on the Pennsylvania Railroad system was one out of about 300,000,000.

The naval board which conducted the tests of the ship brake recently fitted to the battleship "Indiana" reports that, though it will stop a vessel in a short distance, it is unsuitable for naval uses. It considers that unless the brake were constantly employed it would become clogged with barnacles. It would also increase the danger from torpedo attack; would be dangerous in close evolution, and would at all times somewhat retard the speed of a ship.

Secretary of the Navy Meyer announces that he has approved the plans of the two new battleships which have been voted by the Senate and House. Each will be of 27,000 tons displacement and will carry an armament of ten of the new and extremely powerful 14-inch guns. In general appearance, in armor plan, and in disposition of the guns the new ships will resemble the "Florida," which was recently launched at the Brooklyn navy yard.

A comparison of the strength of the navies of the world in dreadnoughts shows that Great Britain has seventeen of 353,700 tons displacement; Germany thirteen of 275,000 tons; the United States ten of 221,650 tons; Japan six of 118,410 tons; Russia four of 92,000 tons, and Italy four of 80,000 tons. France has none of the strictly dreadnought type, either built or building. The above figures include both ships completed and those under construction.

Hollow steel masts are not the only kind that carry away. The English racing yacht "Brynhild" recently lost her solid wooden mast which, in falling, seems to have driven through the light shell of the yacht, causing her to fill and sink in fifteen minutes. The "Brynhild" was racing against the seventy-footers "Shamrock" and "White Heather." Usually the falling mast entirely clears the hull, as happened in the case of both "Columbia" and "Shamrock" I and III during their respective "America" cup racing seasons.

The board of engineers appointed by the Board of Estimate of this city to pass on the plan to distribute the new Catskill water supply in the various boroughs by means of a deep tunnel, one hundred feet or more below the surface, has reported that the tunnel would cost only $26,000,000, as against $47,000,000, which would be the cost of building a system of pipe lines. The construction is recommended on the grounds both of economical first cost and small future cost of maintenance.

The four dreadnoughts which are being built for the Russian navy in Russian yards will have several novel features. They will be 590 feet long, 89 feet broad, of 23,000 tons displacement, and with 42,000 shaft horse-power are designed to make 23 knots. An armament of twelve 12-inch guns is to be mounted in four three-gun turrets placed on the center line. All turrets are on the upper deck, one forward, one between the smokestacks, another between the after smokestack and the mainmast, and the fourth on the quarter deck. The belt armor will be 8.8 inches maximum thickness, which is rather light; but the reduction in thickness was no doubt determined by the fact that in the Russo-Japanese war, belt and turret armor were never penetrated. The armor, forward, is carried up to the forecastle deck, where it is three inches thick, the whole bow being entirely protected. The principal defect of these ships is the small end-on fire of three guns.

AERONAUTICS.

Capt. Baldwin and Joseph Seymour both gave excellent demonstrations on the 4th instant of their proficiency in flying their machines. The latter's biplane is a standard 25-horse-power Curtiss, while Capt. Baldwin has a Curtiss machine with a tail like the Farman and with a chain-driven propeller placed back of the planes and connected to the 25-horse-power motor. The propeller used is somewhat larger in diameter and of higher pitch than that ordinarily employed.

Jacques de Lesseps crossed the Channel on the 21st day of May by way of Calais to Dover with a Blériot monoplane, and thereby won the Ruinart prize of 12,000 francs. Count de Lesseps started from the same downs at Barraquez, near Calais, from which Blériot ascended on his memorable flight. The Count ascended at ten minutes to four o'clock in the presence of 2,000 spectators. His motor was a Gnome, revolving-cylinder engine of 50 horse-power. At a height of 1,600 feet he was lost in a heavy fog. The torpedo boat "Escopette," which performed a similar service for Blériot and Latham, accompanied him, but found it impossible to keep up. De Lesseps was unable to adhere to his course, partly perhaps because of the fog, and as the "Escopette" entered Dover, no one knew anything at all of De Lesseps. He had landed about two miles to the north of Dover, near St. Margaret, and glided down a distance of about two miles after shutting off his motor. He alighted at twenty-two minutes after four, after a journey of forty-two minutes.

After Count de Lesseps's flight across the English Channel with the Blériot monoplane on May 21st (which was the second time this trip had been made by any aeroplane), the Hon. Charles Stewart Rolls, who was the first Englishman to fly with a Wright biplane, on June 2nd succeeded in making a double crossing from England to France and return. The start was made near Dover at 6:30 P. M., and Mr. Rolls covered the 21 miles to Sangatte near Calais in 35 minutes. After circling twice above the cliffs he returned to England, and landed some distance from the coast. Altogether he covered some 45 miles in about 75 minutes. A comparison of the performances of the English and the French aviators appears on another page.

During the first days of June many excellent flights were made at Mineola, L. I., above the grounds that are being used in common by the Aeronautical Society and the Aero Club of America, by a number of new aviators including Mr. Clifford B. Harmon, Capt. T. A. Baldwin, and Joseph Seymour. One day Mr. Harmon made a trip above the surrounding towns. His machine came down owing to failure of the motor, and was slightly damaged. Charles K. Hamilton was present with his Curtiss biplane, and immediately started to Mr. Harmon's aid. After alighting some distance from the latter's machine, and inquiring his whereabouts, Hamilton started his motor by turning the propeller while the motor was throttled, and then climbed into his biplane and started off. The second time he managed to alight near Harmon.

The latest and longest two-passenger cross-country flight was made on the 9th instant in France by Lieut. Feguant and Capt. Marconnet on a Henry Farman biplane. Starting from Chalons at 4:40 A. M., the officers flew 176 kilometers (109¼ miles) cross country to the artillery park at Vincennes, which was reached at 7:10. This flight of two and one-half hours' duration was accomplished at a speed of 43¾ miles per hour. Capt. Marconnet was able to take photographs and make sketches that would have been of great strategic interest in time of war. This is the first practical demonstration of the aeroplane for scouting purposes, in addition to its being a new world's record for cross-country flying with two men in the machine. Another French aviator, Labouchère, flew for ten minutes with two passengers at Mourmelon on the same day.

Previous to attempting a long-distance flight from New York to Philadelphia and back, Mr. Hamilton gave some beautiful exhibitions of his skill in flying at Mineola the first week in June. He would rise to a height of from 200 to 300 feet and circle about, at the same time swooping down to within 15 or 20 feet of the ground and suddenly rising again. When he was about to alight he would shut off the motor at a good height, and dive almost perpendicularly to the earth. When only 10 or 12 feet from the ground he would level up his machine, and make an extended glide only a few feet above the surface. He appeared to ride in the biplane as easily and with the same skill that a bareback rider rides his horse, and he seemed to take as much enjoyment from his dives and other pranks as did the large number of interested spectators. The machine he has used since last winter is the identical racer used by Mr. Curtiss at Rheims. It is very fast, and has also demonstrated its ability to carry two people, since Mr. Hamilton took aloft a friend for a short spin on the 4th instant.

SCIENCE.

Prof. Dr. Hergesell, of Strasburg, president of the International Commission on Scientific Aeronautics, will accompany Count Zeppelin on his expedition to Spitzbergen this summer, and will carry out a series of aerological observations in that vicinity. For this reason it is proposed to hold the "international week" of kite and balloon observations, in which meteorological institutions in all parts of the world participate, from the 8th to the 13th of August, this year, instead of during November, as previously intended.

Bernard Brunhes, director of the observatory of Puy-de-Dôme, and professor of physics in the faculty of sciences at Clermont-Ferrand, is dead at the age of 42. He was the author of many memoirs on physical and meteorological subjects, and of late had been prominent as the champion of the new methods of weather forecasting introduced by G. Guilbert of Caen. Brunhes endeavored to explain on theoretical grounds the methods deduced empirically by Guilbert, but the extensive polemics on this subject in the scientific journals have not led to any conclusive results.

A fund has been established by Mrs. E. H. Harriman for the collection of complete data on mammals and other animals of the North American continent. Dr. C. Hart Merriam, chief of the biological survey of the Department of Agriculture, will resign from the government service to take charge of the work. The late Mr. Harriman was intensely interested in natural history. It was with his financial support that Dr. Merriam visited Alaska a few years ago and collected data which added much to our geological and biological knowledge of that region.

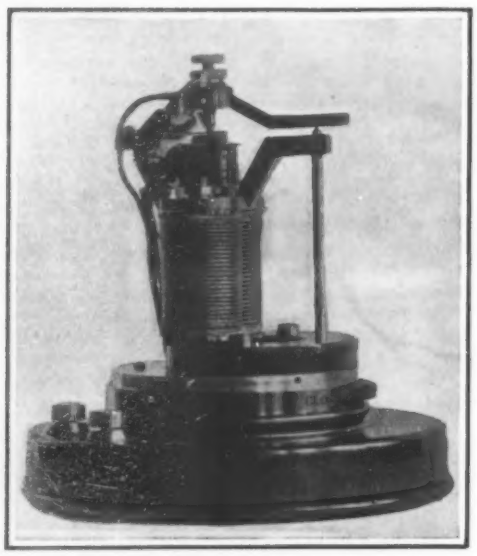
Attempts are being made to produce textile imitations, equal or superior to natural furs in color, gloss, and adaptability to the ever-changing dictates of fashion, and very much cheaper. The substitution would have the further advantage of releasing the natural skins, especially goat skin, for use as leather. Mohair and other long-staple wools are most suitable for this purpose. A recent issue of the Faerber Zeitung contains a detailed description of the process of making imitation furs, including the operations of curling, dyeing with acid dyes, precipitating manganese dioxide on the fibers, steeping in alkali, and transforming the *bistre* shade produced by the manganese dioxide into green, blue or grayish brown.

It has long been well known that the rural population is superior to the population of the cities, and the population of the agricultural eastern provinces of Germany is superior to that of the manufacturing western provinces in regard to fitness for military service. The forty-one large cities, which contain one-fifth of the entire population of Germany, furnish only 17 per cent of its soldiers. Berlin makes the poorest showing of all, furnishing only 39 per cent of the contingent which it should furnish in accordance with its population. Hamburg furnishes 42 per cent of its proper share, Bremen 65 per cent, Alsace-Lorraine 78 per cent. The deficiencies are made up by the eastern provinces. East Prussia furnishes 140 per cent of its proper share, West Prussia and Posen 129 per cent, Pomerania 123 per cent, Saxony 134 per cent. The average height of the recruits from the north of Germany exceeds that of the recruits from the south. The average height for the whole empire is 66 inches, the average for Mecklenburg, Schleswig-Holstein, and Oldenburg is 66½ inches, and the average for Saxony and Silesia is only 65½ inches.

Carborundum, which consists essentially of silicon carbide, is produced in the electric furnace from a mixture of sand, coke, sawdust and common salt. With the exception of the diamond, carborundum is the hardest of all known substances, scratching even corundum, which is the hardest of natural stones except the diamond. The commercial production of carborundum was first accomplished by Acheson, and the Carborundum Company which he founded produces in its works at Niagara Falls large quantities of carborundum, which is in great demand as a polishing and grinding material. The carborundum hitherto produced contains a trace of uncombined carbon and consequently has a dark brown or black color, which makes it unsuitable for decorative purposes. Recently however Frank Tone, of the Carborundum Company, has devised a method of producing colorless and transparent crystals of carborundum, the refractive index of which is said to be even greater than that of the diamond. These crystals are produced by charging the furnace with a mixture of 30 parts of pure carbon, 37 parts of quartz, 9 parts of sawdust, and 4 parts of salt. All trace of color is removed from the crystals by the addition of a small quantity of a metallic oxide, such as oxide of chromium. As the refractive power of the diamond is one of its most valuable properties, and the carborundum crystals possess this property in a still higher degree, these new gems may become serious rivals of the diamond, if they can be produced in suitable shapes and sizes, and can be cut and polished like diamonds.

A TELEPHONIC STETHOSCOPE

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN



Telephone relay with casing removed.

Great interest has been centered among British telephonic and medical circles in the interesting device invented by Mr. S. G. Brown, which was recently described before the Institution of Electrical Engineers. The vital feature of this invention is the successful perfection of a telephone relay. For many years inventors have been trying to develop such a relay, but have been baffled by difficulties which many engineers have declared to be unsurmountable. As the outcome of six years' patient study and experiment, however, Mr. Brown has achieved success, as tests over the trunk telephone lines of Great Britain have strikingly demonstrated.

This relay, which is shown in the accompanying illustration, and the design of which may be gathered from a reference to the explanatory diagram, is developed upon entirely new lines and is based upon the researches of Prof. J. J. Thomson, Earhart, Kinsley, and others, concerning the flow of electrons across a microscopic air-gap between two conducting surfaces at different potentials. Earhart found that, when the metallic circuit is broken by a minute opening of the order of 0.000,000,5 centimeter and the metal at the point of interruption is platinum, the current will flow round the circuit and across the opening, and when this interrupting space, which Mr. Brown terms the "conduction" space, is slightly altered in length, the resistance is varied, and the value of the current flowing round the circuit is greatly affected. This constitutes the fundamental basis of Mr. Brown's invention; for he points out that this conduction space is just what is wanted for the current carrying device of a telephone relay, where microscopic mechanical movements have to be converted into large current changes. But the dimensions of this conducting space are so minute that it is a difficult matter to insure and maintain it by mechanical means. Therefore he devised a method whereby the current flowing across the conducting space effects its own adjustment in very much the same manner as the current that passes through an electric arc lamp strikes and maintains the length of the arc.

In the diagram, Fig. 1, there is a permanent magnet *N*, which is continued by soft iron poles right up to, but not touching, the "invar" steel reed *P*. Two sets of coil windings *H* and *K* are wound round these soft iron pole extensions, and the telephone currents to be magnified circulate round the winding *H* and consequently by varying the magnetism set the reed *P* in vibration. There are top and bottom metal contact pieces *M* and *O*, which are opened to an infinitesimal degree by the fine adjusting screw *W*, and by the action of the local current passing through the contact and around the winding *K*. It is the action of the local current operating through this winding which forms and subsequently maintains the conduction space.

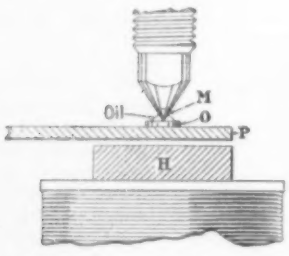


Fig. 2.—The reed and contact pieces.

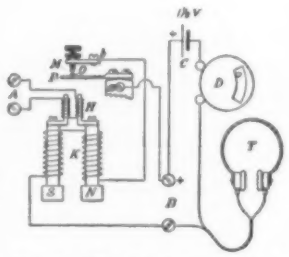


Fig. 3.—Electrical connections of the relay.

This automatic adjustment is so absolutely perfect that the instrument may be turned upside down and yet produce scarcely any appreciable alteration in the value of the local current, and certainly without exercising the slightest effect upon the action of the relay. The regulating winding *K*, however, must not act when traversed by the rapidly varying telephonic currents, and this end is assured by surrounding the iron under the coil by a closed circuited copper sheathing. Eddy currents set up in this sheathing by mutual induction destroy the self-induction of the coil. In the instrument illustrated herewith the contact between the reed *P* and the contact pieces *M* and *O* is effected with metal pieces of hard osmium iridium alloy, the top contact being pointed like a pencil (Fig. 2) with the lower one flat and affixed to the reed. Both are polished and work under a small drop of thin oil.

The connections of the relay are shown in Fig. 3. The telephone currents to be intensified enter by the terminals *A*, and circulate through the winding *H*. At *C* is a dry cell of normal voltage; at *K* the low resistance regulating winding; at *T* the telephone receiver of approximately 40 ohms resistance, and at *D* an ampere meter or current indicator. The relay usually acts at its best adjustment when the microphone contact is opened so as to reduce the local current to half its maximum value.

The extent to which it magnifies speech on ordinary lines is striking as trials have demonstrated, and the great value of the invention is that the intensification of sound is secured without any perceptible loss in the articulation. It will also work with large currents to a point at which the Bell receiver in its local circuit is responding with uncomfortable loudness. Tests over a 20 pounds standard cable speaking only one way, have proved that, when this relay is introduced, 30 miles may be added to any length through which it is now possible to speak direct. That is to say supposing the length of the core for direct speaking is 20 miles, by applying the relay to the circuit the distance may be increased a further 30 miles, the relay being placed in circuit either as a repeater at the end of the first 20 miles, or as a receiver at the end of the 50 miles.

The tests show that the telephone currents have their strength increased to something like twenty times. Should still greater intensification be desired then it is only necessary to place two relays in tandem, by which means magnification is increased to 400 times. Moreover, if a piece of soft rubber be made to touch the reed to assist the natural electrical damping of the reed, the voice can be transmitted more distinctly and clearly than if the conversation were taking place in a room, owing probably to the complete absence of echoes.

The introduction of the local regulating winding *K* converts the metal contacts *M* and *O* into microphones of extreme delicacy securing a far finer degree of sensitiveness than could be obtained by light pressure between carbons. In view of this fact Mr. Brown continued his investigations and succeeded in evolving an electrical stethoscope whereby the sound of heart beats and other internal organs is very greatly magnified.

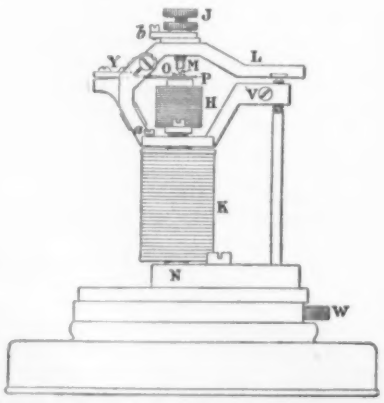
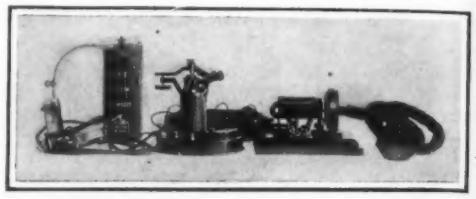
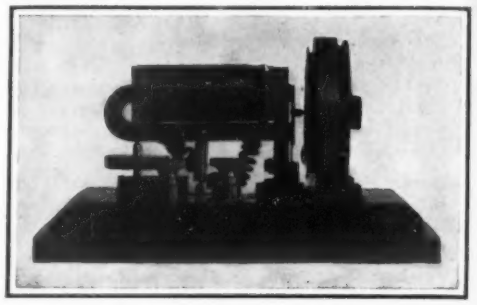


Fig. 1.—View of the relay with the brass cover removed.

A TELEPHONIC STETHOSCOPE.



Combined stethoscope and telephone relay.



Electric stethoscope with transmitter removed.

This stethoscope is highly ingenious and its design is shown diagrammatically in Fig. 4, while the photographic illustration conveys an idea of its general appearance. The transmitter, if such it may be termed, represented by *A* comprises a shallow brass cell faced with a thin diaphragm of ebonite. This is placed upon the body in the region of the heart, or other organ to be examined, as with the ordinary instrument, and the sound of the beat or movement is conveyed to the ebonite diaphragm, then to the air within the tube *B* to which the transmitter is connected, setting the metal diaphragm *D* in vibration. The contact pieces *M* and *O* are fashioned of osmium iridium, *M* being mounted on the diaphragm *D*, and *O* on the steel reed *P*. The reed, together with the magnet *N S*, is supported on a brass frame *E*, pivoted or hinged at its lower support *Y*. The conduction space is produced between the contacts *M* and *O* by the fine adjusting screw *W*, and by the automatic action of the local current flowing from the cell *C* through the winding *K* and round the magnet. A special telephone transformer of equal windings of about 20 ohms resistance is represented by *T* in the primary and in the secondary.

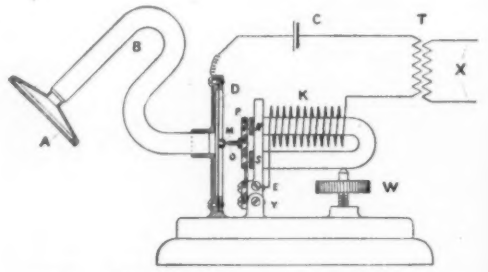


Fig. 4.—Diagrammatic view of the stethoscope.

With such an instrument as this the sound of the heart beat is intensified about three times. But as such magnification is insufficient for practical purposes Mr. Brown connects his telephone relay, as above described, to the transformer wires *X* and the two instruments bring about a sound magnification of about 60 times or more.

The instrument has been tested at the London Hospital, where it was submitted to a number of authenticated heart disease cases. The physicians conceded that the instrument was far in advance of any stethoscope that they had previously used. When it was applied directly to the heart the sounds in the telephone receiver were heard with uncomfortable loudness, and were even audible to the person examined as well as those standing around. But as in such medical work other sounds in the human body, such as breathing which is markedly shrill, might interfere with the heart beat sounds, Mr. Brown has devised ways and means for securing selection and eliminating these extraneous and possibly confusing noises. The metal diaphragm *D* and the reed *P* of the telephone relay are tuned to a synchronous pitch by a proper proportioning of the air in the tube *B* between the

(*Concluded on page 509.*)

A NEW SYSTEM OF COLOR PHOTOGRAPHY

Since the introduction of the Lumiere autochrome color-sensitive plate within the last three years, upon which a composite color picture is made at one operation direct in the camera, quite an impetus has been given to improvements in this line, which will overcome one of the drawbacks of the French process, that is, the difficulty of securing duplicate color photographs except by succesive exposures in the camera.

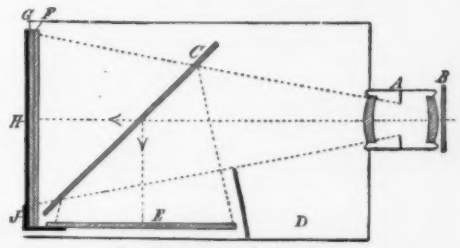
The new system we are about to describe has this particular feature, that duplicate color pictures can be obtained *ad libitum* from the first negative obtained in the camera. It has been perfected and simplified by Mr. Frederick E. Ives of this city, and is quite unique in the way certain apparent difficulties are overcome.

The process is based on the merging of the three primary colors, red, blue, and green. It is not quite as simple in operation as the autochrome process, but possesses the following definite advantages over that: The sensitive plates used keep better, developing successfully when several months old, and cost but half as much as the autochrome plates; the positive transparencies are made by a separate process from the finished negatives, thus permitting the making of any number of duplicates; the transparencies transmit many times as much light as autochromes, and are quite free from granularity, so that they are perfectly adapted for use along with ordinary lantern slides in the lantern, also for use in the stereoscopes; the process also permits of local treatment to modify the colors when and where desired with extraordinary facility, a feature which will be greatly appreciated by the artistic amateur.

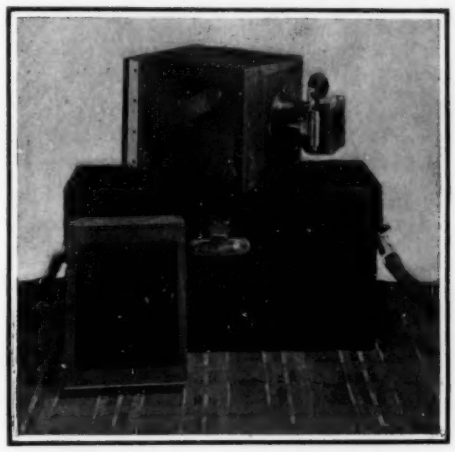
A special camera is required to make the triple negatives, but it is very simple, and can be used without change for all ordinary kinds of photography with plates or films.

When it is desired to make a set of triple negatives for color photography, a "trichromatic plate pack," consisting of three sensitized plates held together as one, is used in the special plate holder instead of a single plate, and is so disposed in the camera after the plate holder has been inserted as to produce by one exposure three negatives, representing the three primary colors. The "plate pack" consists of a red-sensitive and a green-sensitive plate with the sensitive or film surfaces in contact, held between a backing card and a blue-sensitive plate which is hinged thereto by a strip of gummed paper. When the pack is inserted in the plate holder the red- and green-sensitive plates are retained by ledges, and are pressed in close contact, film against film, by a spring on the lid, but the blue-sensitive plate is made slightly shorter, so that it falls or passes outward between the ledges. When the opaque slide of the plate holder is withdrawn, in preparing for an exposure, this plate falls outward into the camera, resting on the bottom of the latter in a horizontal position at right angles to the other plates. After this a yellow screen plate is dropped down from the camera roof by means of a lever on the exterior, as shown in the diagram, and the usual compensating screen is placed over the lens tube. Then the exposure is made by means of the lens shutter, which is said to be about as long as that required for an autochrome plate.

Referring to the diagram, *A* is the lens having a compensating color screen *B* attached to it, which equalizes the exposure for the three images and perfects the color selection. *C* is a hinged transparent



Interior arrangement of camera.



The camera, plate holder, and carrying case.

THE IVES SYSTEM OF COLOR PHOTOGRAPHY.

yellow glass reflector, and *D* is a light trap. *E* is the dry plate sensitive to the blue rays, lying in a horizontal position, which receives the image reflected downward by the yellow glass reflector *C*. As the lens image passes directly through the reflector *C*, only the green and red rays act on the vertical sensitized plates respectively, *F* and *G*. The film of *F* is in contact with the film of *G*, hence the light acts first on the back side of the film *F*, but some of it passes through the film, and impresses the front side of the film on the red-sensitive plate *G*.

After exposure the reflector *C* is turned upward in contact with the roof of the camera by a knob on the outside; then the plate *E* is placed in a vertical position against the other plates by means of another lever on the outside (shown in the engraving) and the slide of the plate holder is inserted.

H and *J* represent an opaque backing card and a flexible hinge attached to the plate *E*, the plate *F* being loose, but held clamped between *H* and *E* when the pack is closed.

The plate holder is inserted at the back of the camera under a ground-glass frame held by springs in the usual way. Focusing is done by moving the lens inward or outward through a tube on the front.

It is evident from this arrangement that the image on each plate must be exactly the same, but that two of them will be "reversed," one by reflection and the other because made through the glass side of the plate.

In making positive duplicates on the film, it is only necessary to reverse the position of the print from the positive-positioned negatives to make all three positive prints coincide when bound together between two glass plates to form one harmonious transparent colored picture. The collodion positive film is so thin that accurate registration of the three films is not affected.

The exposed plates are developed by time development as a unit held in a special rack, they being separated open like the leaves of a book in a tank filled with an amidol developer. The resulting negatives show no color, but contain the color record in black and white, and when finished are available at any time for making natural color transparencies.

To make the transparent color prints, the three negatives are placed side by side in a printing frame. A sheet of collodion bearing a coating of bichromated fish glue is laid collodion side down on the negatives, the back of the printing frame put in, and then exposure made to light through the negatives—about one minute in clearest sunlight. The exposed sheet is then removed from the frame, clamped coated side up on a glass, and developed by washing with water under a tap for a few seconds. This gives three graduated low-relief prints which are perfectly transparent, but they are then cut apart and immersed in separate red, blue and green dye baths for a few minutes (the dyes to be furnished in their proper colors), then rinsed off, dried, and superposed in register to make the complete natural color transparency. The same negatives are available for color prints on paper, but the processes for making color prints on paper are not yet nearly so simple and satisfactory as the transparency process.

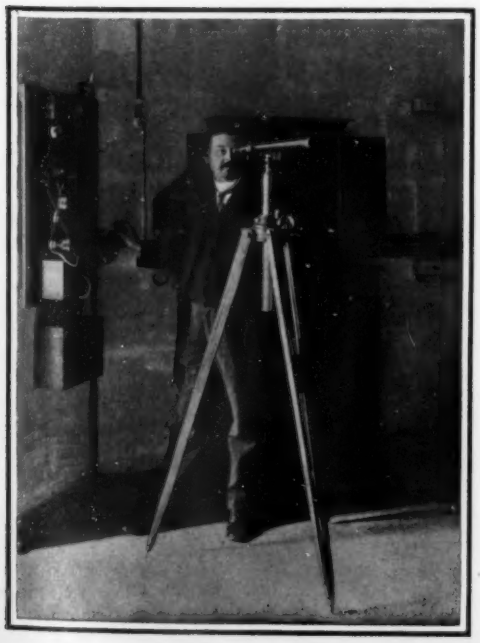
The appearance of the camera and plate holder and the case for carrying the apparatus is shown in the illustration. It is quite compact and simple. Examples of these pictures both in the form of lantern slides and stereoscopic transparencies have been shown us, and they possess a most pleasing brilliancy and transparency in coloring just as one would like to see.

It should be mentioned that Mr. Ives, the inventor of this system, succeeded in developing and perfecting the half-tone and half-tone three-color processes several years ago, and may be regarded as one of the pioneers in color photography. For some of these discoveries he was awarded the Progress medal of the Royal Photographic Society of Great Britain, the Elliott Cresson medal of the Franklin Institute, and a special gold medal from the Photographic Society of Philadelphia.

We are informed that a company in this city under the style of "Ives Inventions" is soon to introduce this latest system, which seems to be of a very practical character.

WIRELESS TIME SIGNALING TO SEA FROM THE EIFFEL TOWER

BY F. HONORE

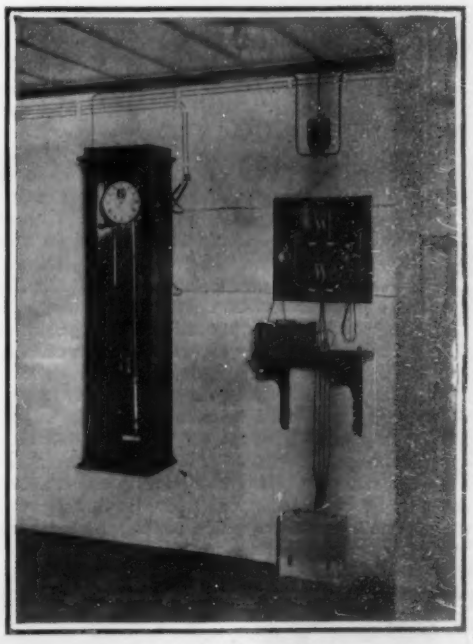


WATCHING THE PENDULUM THROUGH THE TELESCOPE.

The wireless telegraphic station of the Eiffel Tower is now signaling Paris Observatory time to all vessels within a radius of 1,800 miles. The present station is using 15 to 16 horse-power. When the new installation, whose completion was delayed by the recent floods, is finished, 100 horse-power will be at the disposal of the engineers, and the range will be doubled.

A master clock, which has long been used for the correction of marine chronometers, is set up in a room of the observatory, side by side with clocks that telegraph mean time to various centers in Paris, and sidereal clocks which serve to regulate this mean time. The master clock in question itself indicates mean time with reference to the meridian of Paris. Inclosed in a glass case, and suspended from a wall so thick that vibrations in masonry and variations in temperature cannot affect the mechanism, it is corrected each day, if necessary, by means of a magnetic regulator. The rod of the pendulum carries a magnet, the lower end of which is spaced a few millimeters from a solenoid. Depending upon the direction of the current which is sent through the solenoid, the magnet is attracted or repelled, thus retarding or accelerating the beat of the pendulum. In this manner a lost second is regained in thirty-six minutes.

The clock is connected by wires with the key of the wireless station of the Eiffel Tower. At midnight, at 12:02, and at 12:04, the clockwork automatically



CLOCK WHICH AUTOMATICALLY TELEGRAPHS TIME.

completes a circuit, thus actuating a Morse key and causing Hertzian waves to be emitted.

The observatory itself is not equipped to send wireless signals, but it receives them by means of a small aerial connected with telephonic receivers. On the other hand, by means of a Morse key in the circuit of an ordinary telegraph system, independent of the clock, the wireless apparatus on the Eiffel Tower can be operated from the observatory.

At the proper time each day, an official dons a telephone headpiece, and proceeds to the work of notifying vessels at sea of the correct time. One finger on the Morse key, his eye glued to the end of a reading telescope, the official watches the beat of the pendulum. At 11:59 he depresses the key, and by means of agreed signals, he attracts the attention of vessels in the range of action. At midnight, the clock automatically signals the hour. This transmission of time is repeated twice, as we have said, namely, at 12.02 and at 12:04, preceded by other combinations of warning signals. Hence vessels receive the time thrice in five minutes.

The officer on board the vessel at sea is similarly equipped with a telephone headpiece, and he watches a chronometer instead of a clock. Making due allowance for possible errors of observation, he estimates the error of his chronometer.

Esperanto and Ido.

In last week's Scientific American Supplement we chronicled the fact that a new international language has made its appearance, which is a strictly scientific attempt made by an international commission of philosophers, scientists, and pilologists to improve Esperanto and to provide the world with an artificial language which shall be truly international. Some of our Esperantist friends have misunderstood the purpose of the commission, and do not fully realize the scope of the improvement which has been effected. They have written rather heated protests against the article which we published. We are neither Esperantists nor Idoists, but it seems to us that a fair examination of the International Commission's work must convince anyone of the valuable service which it rendered. Below we republish Prof. O. Jespersen's views of the limitations of Esperanto, taken from a recent book published by the Délégation pour l'adoption d'une langue auxiliaire internationale:

"Dr. Zamenhof has given us an interesting account of the way in which his language gradually developed in his mind while he was at the Warsaw Gymnasium. Before he arrived at the conviction that the material for the vocabulary must be obtained from the Romance and Germanic languages, and that the already existing stock of international words must be used, he had 'simply invented' his words, that is to say, chosen them quite arbitrarily, but with as much regard to system and brevity as possible. Although he himself noticed that such words are difficult to learn and still more difficut to remember, he has unfortunately retained in the finished language a whole series of such *à priori* formations, which appear in words of such frequent occurrence as 'who,' 'how,' 'where,' 'never,' 'everywhere,' etc. The *'nul tempe'* and *'pro quo'* chosen by the Delegation agree, however, much better with the general character of language than the *'neniam'* and *'kial'* of Dr. Zamenhof.

"Some peculiarities may be accounted for by the Slavonic mother tongue of the author: for example, his preference for sibilants and diphthongs, which is especially evident in the invented words (e. g. *chi*, here; *chiu*, each; *ech*, even; *ghi*, that; *ghis*, until, *gh* and *ch* being pronounced as E. *j* and *ch*). In an article in Zamenhof's Krestomatio I find, for example (p. 288) *chiuj tiuj senantaujughaj kaj honestaj homoj, kiuj, anstataŭ filizofadi pri ghi*, and (p. 293) *tion chi ankorau antau la apero de la unua arta lingvo antauvidis kaj antaudiris chiuj tiuj eminentaj kapoj, kiuj*, etc. The method of writing 'x' is also Russian: *ekzameni, ekzemplo*, etc., and also *ekspedi, eksplodi;* also *kv* for *qu*. French words with *oi* take *ua* in Esperanto when they are spelt in this way in Russian, e. g. *trotuaro, tualeto, vuala;* otherwise they are spelt with *oi* or *oj*, e. g. *foiro, fojo, foino*. *Nacia, tradicio*, etc., instead of *-iono*, is also Russian. Russian usage has doubtless also inspired such word formations as *elparoli* and *senkulpigi* instead of the international *pronuncar* and *exkuar* (Russian *vygovarivat'* and *izvin'at'*, corresponding to German *aussprechen* and *entschuldigen*). The peculiarity of using the adverb instead of the adjective in such cases as *estas necese vidi*, 'it is necessary to see,' is probably to be ascribed to the correspondence of the Russian adverb with the neuter predicate adjective. This rule cannot be permitted, however, in an international language, because, with a free word order, it would be impossible to say whether *estas vere necese* means 'it is really necessary,' or 'it is necessarily true.' The compound perfect (*mi estas aminta*, 'I have loved' = 'I am having love') reminds one of the Polish *kochal-em*. Finally, the frequent use of the adjective (in *-a*) instead of the genitive (*Zamenhofa lingvo*) and of the two sorts of action expressed by *ek* and *ad* (*ekvidi* and *vidadi* used in many cases where the simple *vidi* would be sufficient), are to be accounted for by Russian usages.

"Naturally I do not object to the importation of national peculiarities into the international auxiliary language when the latter is enriched thereby. For example, one must make use of the facility for forming compound words common to the Germanic and Slavonic languages in preference to the poverty of Romance languages in this respect, and combine it with the more Romance characteristic of forming new words by means of derivative syllables. But peculiarities of national language which render mutual comprehension and international usage difficult must be most carefully avoided.

"The unpractical nature of the circumflexed letters has been indicated. It may be remarked here, however, that in point of system Zamenhof's letters are very inferior to the similar ones employed in the Czech language, since the parallelism in sound between *s* and *ŝ*, *z* and *ĵ*, *dz* and *ĝ*, is disguised by the choice of letters. This produces a very amateurish effect.

"Beside the familiar parts of speech which are indicated by special terminations, Zamenhof invented a new class characterized by the termination *-au* (*kontrau, almenau*); but the limits of this class, which includes some, but not all, adverbs and prepositions, are not clearly defined.

"Many words taken from existing languages are disguised, almost after the fashion of Volapük; *boji*, French *aboyer; parkere*, French *par cœur; schvit*, German *schwitzen*, English *sweat;* char, French *car; faruno* instead of *farin; lerta*, French *alerte* (with a changed meaning), etc. In this category is to be classed the astonishing *nepre* (entirely) which is derived from the Russian *nepremenno*, just as if one were to take from the German word *unbedingt* the first two syllables and propose *unbe* as an international word instead of *absolute*. The economy in the use of stems was carried much too far in Esperanto, necessitating the employment of all sorts of compound words, the discovery of whose meaning requires much racking of one's brains. The employment of all the derivative syllables also as independent words is very ingenious, but produces a very strange impression on the uninitiated.

"The method of word formation is greatly wanting in precision, the limits of the so-called direct derivation in particular being not sufficiently clearly indicated. One example will suffice. Starting out from *kroni* = to crown, *krono* ought properly to mean *crowning*, instead of which it signifies *crown*, so that one is forced to use *kronado* for *crowning*, whereas, according to the rules of Esperanto, *kronado* must mean continuous or repeated *crowning*, as if a king were being constantly or repeatedly crowned.

"I have brought together here the most important defects in Esperanto, the removal of which formed one of the tasks of the Delegation Committee. The knowledge of these imperfections does not prevent me from recognizing the meritorious services of Zamenhof, who, at a time when the question of the best construction of an international language was not seriously discussed, succeeded in producing one which was in many respects superior to the attempts of that time, and which has proved in practice a serviceable, though very imperfect, means of international communication."

The Government and the Inventor.

We recently commented upon a bill which is being considered by the House of Representatives, the purpose of which is to compensate those inventors whose inventions have been appropriated by the government. Since the publication of our remarks, further testimony has been taken before the Committee on Patents, which reveals the hardships of an inventor who endeavors to create something which will be of benefit to his Government, which only the Government can use, and for which he has only one customer, and that is the Government itself.

One such invention is a torpedo system with a trolley guide, which was conceived by Mr. William S. Brewster, while he was associated with Mr. Edison. It was at the time Mr. Edison and Gardner Sims were perfecting the Edison-Sims torpedo. Mr. Brewster thought that instead of guiding the torpedo to its destination by its own mechanism, it could be guided by a trolley system. He consulted Generals Newton and Abbot, who were then prominent engineers in New York, about the system, but he never took any patent out until advised to do so by a prominent officer in the War Department. In 1896 he applied for a patent, which was issued in 1897, and which was offered to the War Department at practically the Department's own terms. The patent was granted for an invention which Mr. Brewster could not use himself and which the Government might use if it found it serviceable. The offer was declined. In 1898, at the time of the Spanish war, the invention was again offered to the Government, with the understanding that any reasonable remuneration would be accepted. In June, 1908, it was announced that the Navy Department was going to test a new trolley-controlled torpedo off Fortress Monroe, against a modern battleship to note the effect. Immediately before the test took place Mr. Brewster wrote to the Navy Department and inclosed a copy of his patent, and a bill for the use of his patented trolley system in this torpedo test at Hampton Roads. In so far as the Government used his trolley to guide the torpedo so that it should strike the target, Mr. Brewster thought that it appropriated his invention. One of Mr. Brewster's claims reads:

"In a submarine torpedo system, a submerged cable constructed and adapted to constitute a track for guiding and controlling a torpedo in transit, and a torpedo connected thereto, substantially as set forth."

This is so broad that the Government obviously infringed.

The trolley system has since been used in testing the Davis torpedo gun. Mr. Brewster wrote again to the Navy Department asking for compensation for the use of his invention. The Navy Department replied that the Electric Boat Company was making the tests of the Davis torpedo, although, as a matter of fact, the contests were actually conducted by officers of the navy. Lieut. Commander Davis acknowledged the use of the guide, saying that he did not know of the patent. Further correspondence with the Navy Department led to a controversy on the scope of the patent and the price demanded, and finally ended in a flat refusal to pay.

Another shining example is to be found in the utilization by the Government of Prof. R. A. Fessenden's improvements in wireless communication. Prof. Fessenden was employed for about a year in the Weather Bureau. One or two of his early inventions were produced during his employment, but all of his later ones have been produced since. Some of his patents have been the subject matter of suits in the Circuit Court of the United States and have been sustained. Infringements of them have been enjoined. The unsuccessful defendant in one suit tendered infringing wireless material to the Navy Department. Prof. Fessenden protested against the Navy Department's purchasing the material from the infringer, calling its attention to the fact that a court of the United States had enjoined it from furnishing such material. The Department replied, rather autocratically, that, however that might be, it preferred to purchase material in the cheapest market and leave it to the patentee and infringer to work out their salvation as best they could. The infringer proceeded to furnish the material contracted for and delivered it to the Navy Department. The furnishing of that material was used as the basis for contempt proceedings. The officers of the infringing company were committed for contempt of court, and were fined.

There is now pending in the Supreme Court on writ of certiorari a case brought in the local court by the Krupp Company against General Crozier, Chief of Ordnance, in which it asks for an injunction to restrain him and his subordinates from making guns for the army according to the Krupp patent. When the case came up for decision in the Court of Appeals of the District of Columbia, the Court held that regardless of the fact that General Crozier was an officer of the United States army, he derived no personal benefit from the use of the Krupp patents, nevertheless, he was an infringer. The Krupp Company asked only for an injunction in this case, and not for any compensation for the use made of its patent prior to the final decree. An injunction pure and simple would not be a complete remedy in many cases. General Crozier was merely the agent of the Ordnance Department. The Government of the United States derived the benefit and not he from the use of the Krupp inventions. But that situation does not absolve the Government from paying.

Very often, patents are being infringed by the Government without the knowledge of the patentee, because not every one can walk into a naval gun shop and see what is going on. Machines may be used in the Post Office for years without the fact being discovered. A man may invent a new brand of chewing gum or a child's game and make a fortune. He may invent a useful gun or gun carriage, or a new style of armor, or a useful device in the Post Office that would save a great deal of money to the postal service, and get nothing at all for his time and labor except at the caprice or whim of some Government officer.

So hard have been some of the cases that it must be admitted that the courts of the United States have shown every inclination to help the inventor so far as they could. They have followed the decision in the case of McKeever (14 Court of Claims, 396). Going back to English precedents, the judge in that case stated that the patent law of England does not exclude the crown from the use of a patented invention without compensation, that the American law recognizes and always has recognized that a patent is as much property as real estate and ought not to be violated by the Government any more than by a private indi-

vidual or corporation. Yet the Government ignores that decision and refuses to pay.

Hence such actions as inventors have succeeded in sustaining against the United States have been largely based upon implied contracts. Thus in Burns's case (12 Wall, 240) it was held that the offer of the Government to use a patented invention was a valid consideration to support an action on an express contract for royalty. At first sight, it might seem as if patentees already have protection in the remedy which they now have in the Court of Claims for the infringement of their rights by the Government. The courts have, however, found a difficulty standing in the way of granting to inventors a right to damages against the Government in cases where their patents have been used, in the fact that the statutes defining the jurisdiction of the Court of Claims confine it as a rule to cases arising upon contract with the Government. Hence the necessity of bringing actions under contracts implied or expressed. Thus, in the case of Palmer (128 U. S., 262), the patentee invited the Government to adopt his invention, and the Government did so. This was held to amount to an implied contract. In the case of the Berdan Fire Arms Company (156 U. S., 552) the patentee communicated his invention to the officers of the Government, and they used it without expressly repudiating his title. These facts were held to give rise to the implication of a contract. The line is so slight as to be little more than fortuitous, and the distinction is one that is utterly unworthy of a great government desiring to do impartial justice to all citizens.

New Trade Mark Bills.

As the trade mark law now stands, the registration by a corporation of a technical trade mark which may be its whole name or part of its name is impossible. The Court of Appeals has held in a recent decision published in the Official Gazette of July 7th, 1908, in the case of Kentucky Distilleries and Warehouse Company vs. Old Lexington Club Distilling Company, that where the applicant is a corporation, a trade name which is substantially a reproduction of the corporate name cannot be registered as a technical trade mark. That decision was regarded by the Patent Office as authority for making further decisions which are generally known in the profession as the decision in the case of the Champion Safety Lock Company, the Amulet Chemical Company, the Union Carbide Company, and the Success Company.

The situation is anomalous. The Champion Safety Lock Company could not register its trade mark "Champion" under the law as it now stands, or as it is now interpreted by the Court of Appeals, because the word "Champion" is a conspicuous or salient part of the name of the company, while John Smith, who has no rights whatever with regard to the Champion mark, may register the trade mark. Obviously, this is unjust. A bill has been introduced for the express purpose of authorizing the Patent Office to grant such marks and to follow the letter of the law.

In cases such as the Union Carbide Company case there is, however, another element which must be considered. In this case the word "Union" may be regarded as geographical, and "Carbide," of course, as descriptive, so that possibly this is a case where the trade mark should not be registered unless it came under the ten-year clause of the law. But "Success" and "Champion" and "Amulet" and such are obviously valid technical trade marks.

Another instance can be found in the word "Kodak" as applied to photographic cameras. That word is undoubtedly a good trade mark. It has been sustained by courts of this country and courts abroad.

Yet it is ineligible to registration because the company that exploits the manufacture of that particular thing and has the ownership of that mark, has come to be called the "Eastman Kodak Company." It seems unfair that a trade mark which is a good mark should be unregistrable because it happens to be incorporated in the firm name or the corporate name of its owner.

The Committee on Patents of the House of Representatives has also before it for consideration measures which have for their purpose the increasing or facilitating of remedies for trade mark infringement, enabling the Patent Office to keep a more complete record of trade mark claims or rights.

The change proposed in one of the bills permits the registration of non-technical marks if it can be alleged in the application that to the best of applicants' knowledge and belief the marks have been used for ten years prior to the filing of the application. The present law reads "ten years prior to the passage of the act," which was February 20th, 1905. Consequently, merchants who adopted marks in 1896 cannot to-day register them under the ten-year clause of the law, although they have used the marks for about fourteen years. It is perfectly fair to assume that after the mark has been used for ten years, it has become distinctive of the goods. The measure ought to be passed.

Correspondence.

DISTILLING LICENSES.

To the Editor of the SCIENTIFIC AMERICAN:

I have seen in one of your SCIENTIFIC AMERICAN publications an article concerning "Manufacturing Perfumes at Home." You recommend a still for the distillation of flowers; also illustrate such a still. I wish to call your attention to the fact that such still must be registered with the collector of the district in which such still is located, not only before operation begins, but immediately after the still comes into the possession or custody of such person, whether it be a new still, distillery apparatus, or not.

The law requires all stills set up to be registered if for use or not. This applies to all stills, of whatever size and for whatever purpose intended. Any still which is not registered is subject to forfeiture to the United States, together with all personal property in the possession or custody or under the control of such person and found in the building or in any yard or inclosure connected with the building in which the same may be set up. The person whose duty it is to register any still, failing to do so, is subject to fine and imprisonment under section 3258 Revised Statutes (Internal Revenue Department).

Kindly bring this to the attention of your subscribers to avoid any difficulties.

Newark, N. J. H. H. FREUND.

RAISING THE "MAINE."

To the Editor of the SCIENTIFIC AMERICAN:

The recent act of Congress authorizing the raising of the wreck of the U. S. S. "Maine" has given rise to many suggestions for raising her. The wreck has rested on the bottom of Havana harbor for nearly twelve years, and has doubtless settled considerably in the mud. The "Maine" was destroyed by the explosion of a submarine mine, which caused the partial explosion of two or more of the forward magazines. Apart from the loss of life, the results of this explosion were that the vessel from the bow to frame 41 was terribly shattered.

Therefore it can be said that the "Maine" from frame 41 aft is structurally sound, although it is doubtful if anything could be done to repair the shattered forecastle. The debris of the bow could be destroyed by dynamite, and the afterpart raised.

A new bow would then have to be constructed, which could be later joined to the old afterpart. A similar thing was accomplished in 1907, when the White Star liner "Suevic" was wrecked off the English coast. Her afterpart was separated from the bow, which was held fast by the rocks, and she proceeded under her own steam to Southampton, where she was docked. A new bow 212 feet long was built at Belfast, towed to Southampton, and joined to the vessel. Within a year the "Suevic" was able to resume her regular duties as one of the White Star Line's Australian steamers. GERALD ELLIS CRONIN.

Brooklyn, N. Y.

HOW LARGE DOES THE SUN APPEAR TO BE?

To the Editor of the SCIENTIFIC AMERICAN:

Ask ten people how large the sun looks to them when it is in mid-heaven, and you will get ten different opinions of its size, which range from a silver dollar to a cart wheel. The varied opinions are due to the fact that there is nothing with which to compare it when looked at by itself. Before any accurate estimate of its size can be made, we must have some known object with which to compare it.

Thus, when the sun is on the horizon and appears to be close to houses, trees, and hills, it looks very large. To some people it seems as large as a house or tree. Moreover, there are more persons who will agree that it appears to be a certain fixed size under this condition than will agree when it is viewed at the zenith. The diversity of opinion in the latter case results from the inability of the eye to "size up" an isolated object.

This has been proved by projecting a narrow beam of light on a perfectly black, non-reflecting screen so placed that the observer could see nothing but the beam of light and had no way of judging his distance from the screen. The observations of several people under these conditions revealed the fact that there was no certainty about the length of the beam, the apparent length being estimated all the way from a few inches to several feet.

This being the case when the sun is in mid-heaven, how can its size be reduced to some uniform standard?

The most logical answer is found by representing it as a circle located at a fixed distance from the eye.

The average reader holds the printed page about one foot from his eyes when reading. At this distance he can estimate fairly closely the size of the type or an illustration. In fact, a dozen good judges of dimensions can tell the size of an illustration, that does not exceed a few inches, within a small fraction of an inch. These same men, if asked to draw a circle on the sheet that would just cover the sun's disk if held between them and the sun at a distance of one foot from the eye, would produce a series of circles of magnitudes ranging from a twenty-five cent piece to a saucer.

The real size of the circle should be only three-sixteenths of an inch in diameter.

The method of representing the sun's exact size by a circle one foot from the eye is simple. Take a smoked glass, hold it one foot from the eye and scratch pin marks tangent to the sun's disk at the four quarters. When the diameter of the circle inclosed within these marks is measured, it will be found to be very close to three-sixteenths of an inch.

In other words, if a circle of this size were drawn, and in its area were reproduced in proportion to an average sun spot, the observer would be able to examine the small dot at a distance of one foot from his eye with just about the same ease that he could examine the real spot on the sun through a smoked glass. Or, again, if the moon, which is the same apparent size as the sun, and whose disk can be represented by the same small circle, were to be reproduced in miniature within its aren, an observer holding it one foot from his eye could examine it with the same scrutiny that he could examine the full moon with his naked eye.

Detroit, Mich. E. C. LANDIS.

The Current Supplement.

The British Antarctic expedition has started on its journey for the South. Consequently the opening article of the current SUPPLEMENT, No. 1798, in which the equipment of the expedition is described, will prove of interest. Not so many years ago, in his famous book on education, Herbert Spencer put forth a powerful plea for the study of science. Nowadays, however, an advocacy of that kind is not called for, and his book is at present largely of historic value only. Since that time the pendulum has been swinging too far toward the scientific. Prof. Albert G. Keller, in an article on Science and the Humanities, argues for the inevitableness of the humanities and of humanity. He asserts not only that our lives may be enriched by the pursuit of culture in diverse forms; not only that our destinies must be impoverished by the renunciation of all lines save one, but also insists upon the more concrete contention that our special scientific work is bound to suffer as a consequence of the neglect of that for which the humanities stand. In all parts of the civilized world, the least desirable element in the population, from a physical and mental standpoint, is producing more numerous progeny, and it would seem that unless means can be devised to stay this flood of the unfit, in the course of time the entire race must descend to a lower level as regards physical and mental qualities. Of late, the aid of eugenics and more recently still, that of Mendelism, has been invoked to keep the race at a high standard. The methods adopted are outlined in an article entitled "Eugenics and Mendelism." Mr. Paul F. Bauder writes instructively on the quality of light. A sympathetic and appreciative biography is published of the late Sir William Huggins. Elihu Thomson contributes a thoughtful paper on atmospheric electricity. One of the most interesting problems of archæology has been solved by the recent excavations at Arlesia, that ancient city of Gaul where Vercingetorix headed 80,000 of his countrymen in a last gallant, though futile attempt to stem the advance of the victorious legions of Cæsar. The wonders of these excavations are told in an interesting article. Mr. Leon A. Hackett contributes a very exhaustive paper on the processes of cotton spinning.

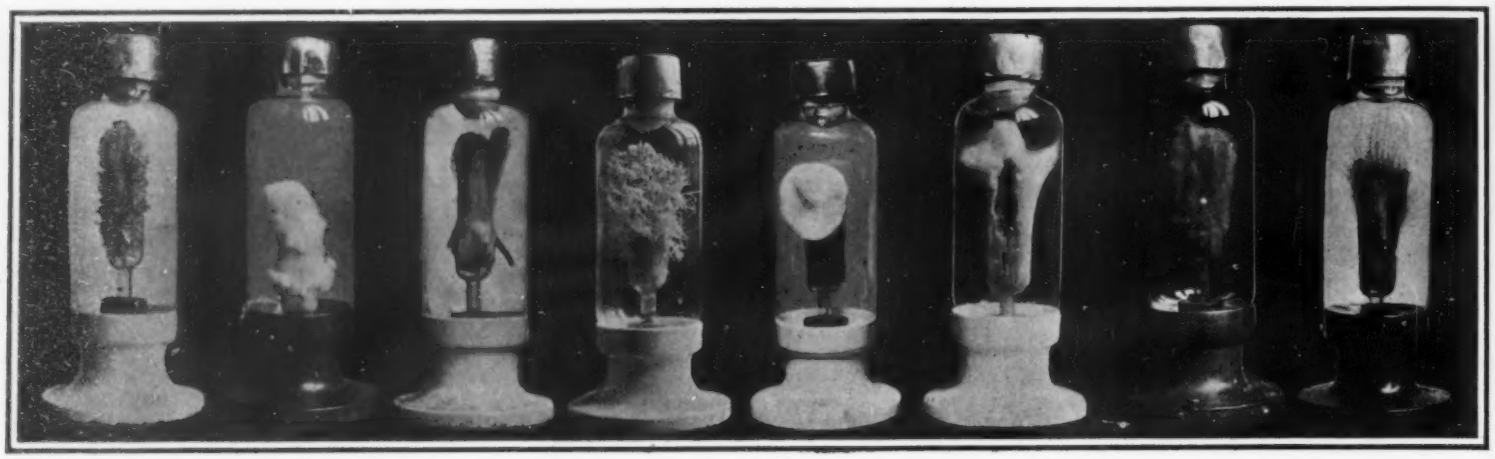
The removal of ashes by conveying them to a waste bank hydraulically is done in connection with the temporary plant built to supply power during the construction of the Rainbow Falls hydro-electric development of the Great Falls Water Power and Townsite Company on the Missouri River, near Great Falls, Mont. The power house is on the side of a hill directly above the edge of the river bank. The bituminous coal used is dumped by gravity from cars on a trestle to a bin at the rear of the firing floor of the boiler-room, and runs down on this floor, from which it is fed by hand to the furnaces. As the ashes fall through the grates they are drawn out into a transverse concrete-lined trench in the firing floor. This trench is sloped to one side of the building, where it connects with a flume extending on a grade of about five per cent to the edge of the river bank. When the grates are cleaned the ashes are pulled into the trench and a hose stream turned into the latter to start them. They are thus picked up by and carried out to the river through the flume, only a small amount of water being required. No difficulty is experienced from clogging in the trench or flume, and the current in the river prevents an accumulation at the edge of the bank.

A GARDEN OF FUNGI.

BY JACQUES BOYER.

The "Mycothèque," annexed to the laboratory of cryptogamy of the Paris school of pharmacy is unquestionably the most original garden in the world. It contains living specimens of 107 species of molds and allied fungi, which M. Bainier has patiently collected, separated, and cultivated on an appropriate medium.

The fungi are sown, or planted, on pieces of licorice root, in bottles of Bohemian glass about 3 inches in diameter and 8 inches high. The mouth of the bottle is closed with a plug of cotton wool. A glass rod, the top of which is enlarged to form a cup, in which the pieces of licorice root are placed, passes through an India rubber stopper which is fitted to a hole in the bottom of the bottle. The miniature greenhouse rests on a base of wood or porcelain.



Penicillium claviforme | *Penicillium candidum* of Brie cheese. | *Sterygmatocystis nigra.* | *Isaria felina.* | *Acrostalagmus roseus.* | *Fusarium* or melon fungus. | *Aspergillus clavatus.* | *Phycomycetes splendens.*

FUNGI CULTURE IN GLASS JARS.

The licorice roots are deprived of their cork-like bark in order to lay bare the yellow alburnum, or sapwood, which is filled with glycyrrhizin, a saccharine substance which is very favorable to the development of mold fungi.

Before the mold spores are sown the bottles containing the pieces of licorice root are sterilized by heating them to 248 deg. F. for one hour in an autoclave. One of the accompanying photographs shows M. Bainier sowing the spores by removing the cotton plug, and depositing a few spores on the licorice root by means of a platinum wire, sheathed in a glass rod. The platinum wire is sterilized by passing it through the flame of a Bunsen burner before it is dipped in the mold culture and the cotton plug is instantly replaced after the sowing. The bottle is then placed in one of the cases in the Mycothèque, where the mycelium of the fungus rapidly permeates the licorice root, which becomes covered with a growth which varies greatly in appearance according to the species.

Syncephalastrum develops a dense mass of long, grayish hairs, *Isaria felina* resembles a shrub with many branches, and *Acrostalagmus roseus* presents the appearance of a white felt hat. The reproductive filaments of *Penicillium*, at first simple and later branched and resembling a brush, bear chaplets of green, gray, yellow or rose-colored spores. Minute drops of water often condense on the brush of *Penicillium claviforme*, producing a very beautiful effect.

In order to obtain a pure and isolated species in each bottle, interlopers of other species are carefully removed and the bottle, if necessary, is replanted two or three times. The principal function of the collection is to supply the laboratory with living specimens of assured purity of type for use in research and in the illustration of lectures.

The position of the curator is no sinecure. When the nutrient material has been exhausted, the fungus will perish unless special methods of preserving its life are adopted. M. Bainier, having learned by experience the length of time during which the spores of each species retain the power of germination, arranges his operations accordingly, planting every week one or another of the four hundred species of cryptogams confided to his care. Some mold spores retain their germinative power for several years, while others die in a few weeks.

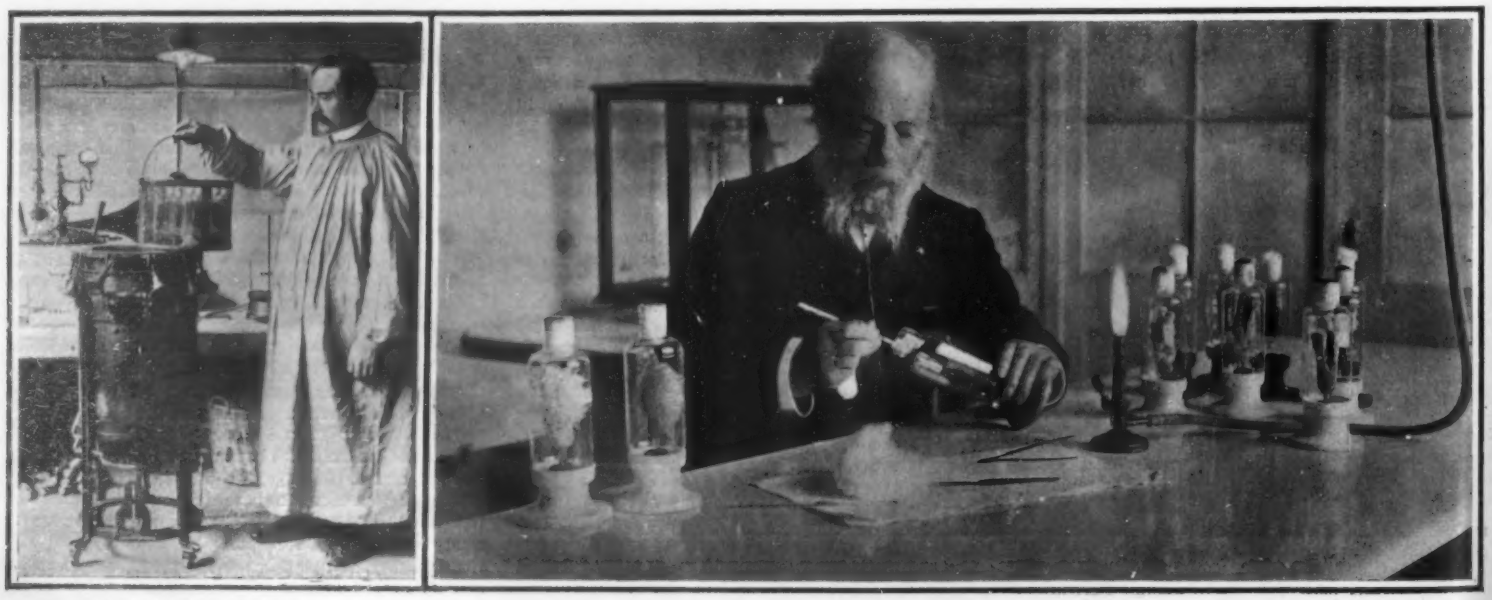
The adoption of this method of culture has led to the discovery of numerous errors in published descriptions of species, attributable to the fact that the species described were not completely separated from others. In some cases the reproductive organs of one species have been assigned to another.

The following are a few of the most interesting species found in this unique garden. Among the 27 species of *Mucorini*, or molds, we observe *Mucor mucedo*, the common brown mold which attacks many substances and especially infests horse dung; *Chlamydomucor orizae* and *Rhizopus orizae* which are used in the Orient in the production of fermented liquors from rice; *Amylomyces Rouxii*, or Chinese yeast, which is used for the same purpose by the Chinese and was introduced into Europe by Dr. Calmette, director of the Pasteur Institute at Lille, and a number of European species, which likewise possess the two-fold power of transforming starch into glucose and of converting glucose into alcohol and carbon dioxide. Among these species is *Mucor racemosus*, which is frequently seen growing on decaying vegetable matter. *Phycomycetes splendens* exhibits delicate filaments terminating in little balls. An allied species, *P. niteus*, is employed to heighten the brilliancy of carmine by consuming the fatty ingredients of cochineal. The single genus *Penicillium* is represented by 17 species. *P. glaucum* is the common green mold which attacks bread, fruit and other articles of food. Various sorts of cheese owe their characteristic flavors to species of *Penicillium*. Brie and Camembert to *P. candidum* and *P. album*, and Roquefort to *P. virescens*, which develops inside the cheese and produces the characteristic green veins.

The genus *Aspergillus* is represented by 6 species. *A. orizae* is used in Japan in the fermentation of the national beverage, sake, or rice beer. *A. fumigatus* attacks the mucous surfaces of the respiratory organs of birds and produces a pseudo-tuberculosis in pigeons fattened by the cramming process. There are 15 species of *Sterygmatocystis*, including the celebrated *S. nigia* (also called *Aspergillus niger*) which was studied so minutely by Raulin.

The collection also contains various fungi which are parasitic upon insects, including *Cordiceps*, which infests caterpillars, and *Botrytis*, of which one species causes the muscarine disease of silkworms, and others have been employed to destroy May beetles and locusts.

Alfred M. Angot, director of the meteorological service of France, has reported to the Academy of Sciences that no exceptional variations in terrestrial magnetism or atmospheric electricity were observed in the neighborhood of Paris during the night of May 18th-19th, when Halley's comet was in transit. The meteorological observations also failed to indicate any disturbance that could be attributed to the comet.



Sterilizing the bottles. Planting the fungi.

A GARDEN OF FUNGI.

THE TEMPERATURE OF THE STARS

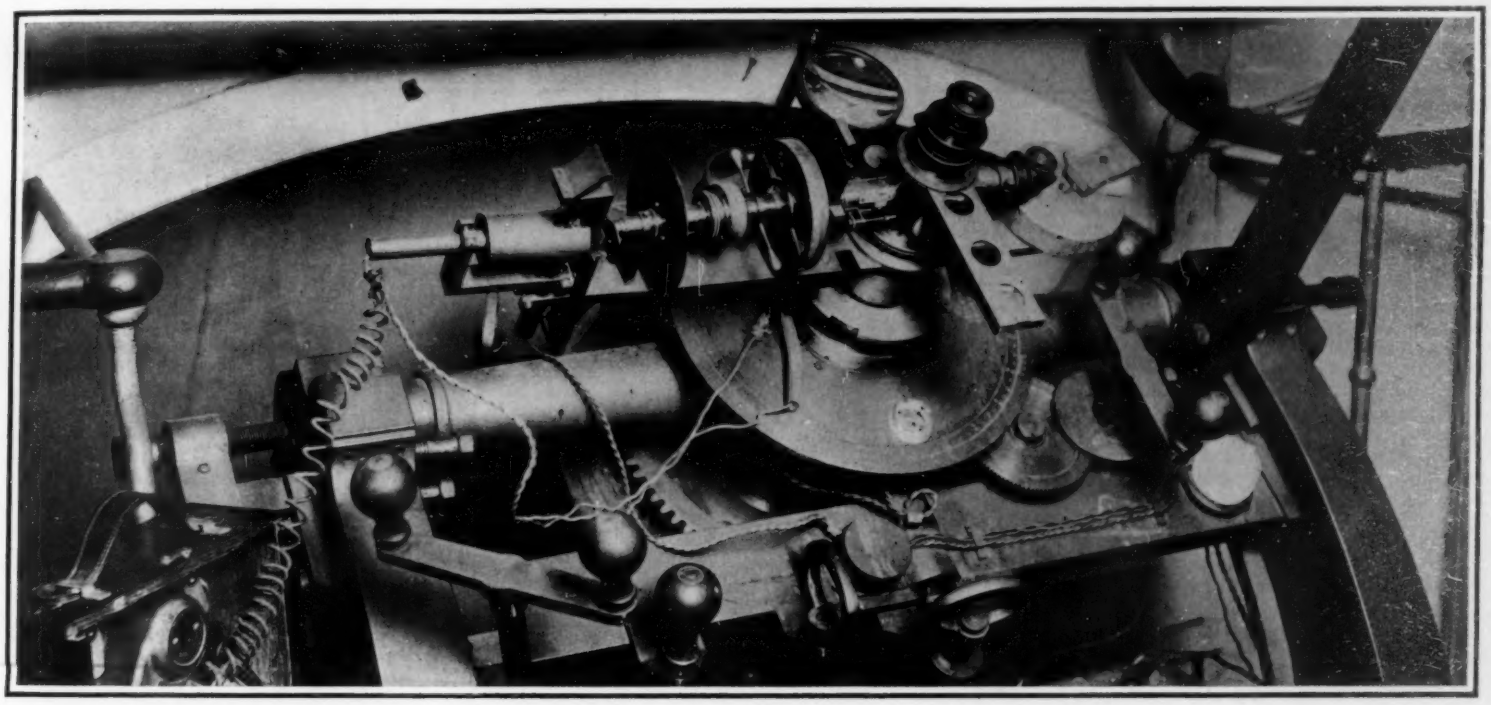
BY JOSEPH BARTON

By means of his heterochrome stellar photometer, M. Charles Nordmann has succeeded in obtaining, in addition to other interesting results, measurements of the effective temperatures of certain stars. The apparatus consists of a lateral attachment to the eyepiece of an equatorial telescope and, like the Zollner photometer, it allows the focal image of the star to be placed in juxtaposition to that of an artificial star. This part of the apparatus contains two Nicol prisms, the third Nicol and the quartz plate of Zollner's photometer being suppressed. Furthermore, between the focus and the eyepiece, in the common path of the rays of the real and the artificial star, is placed a sliding drum, which carries interchangeable cells filled with colored liquids. In this manner a series of mono-chromatic images of the real and artificial stars can be produced. The photometric measurement is made by rendering the images of the two stars equally bright by turning the two Nicol prisms, which are interposed in the path of the rays from the artificial star, and are provided with graduated circles.

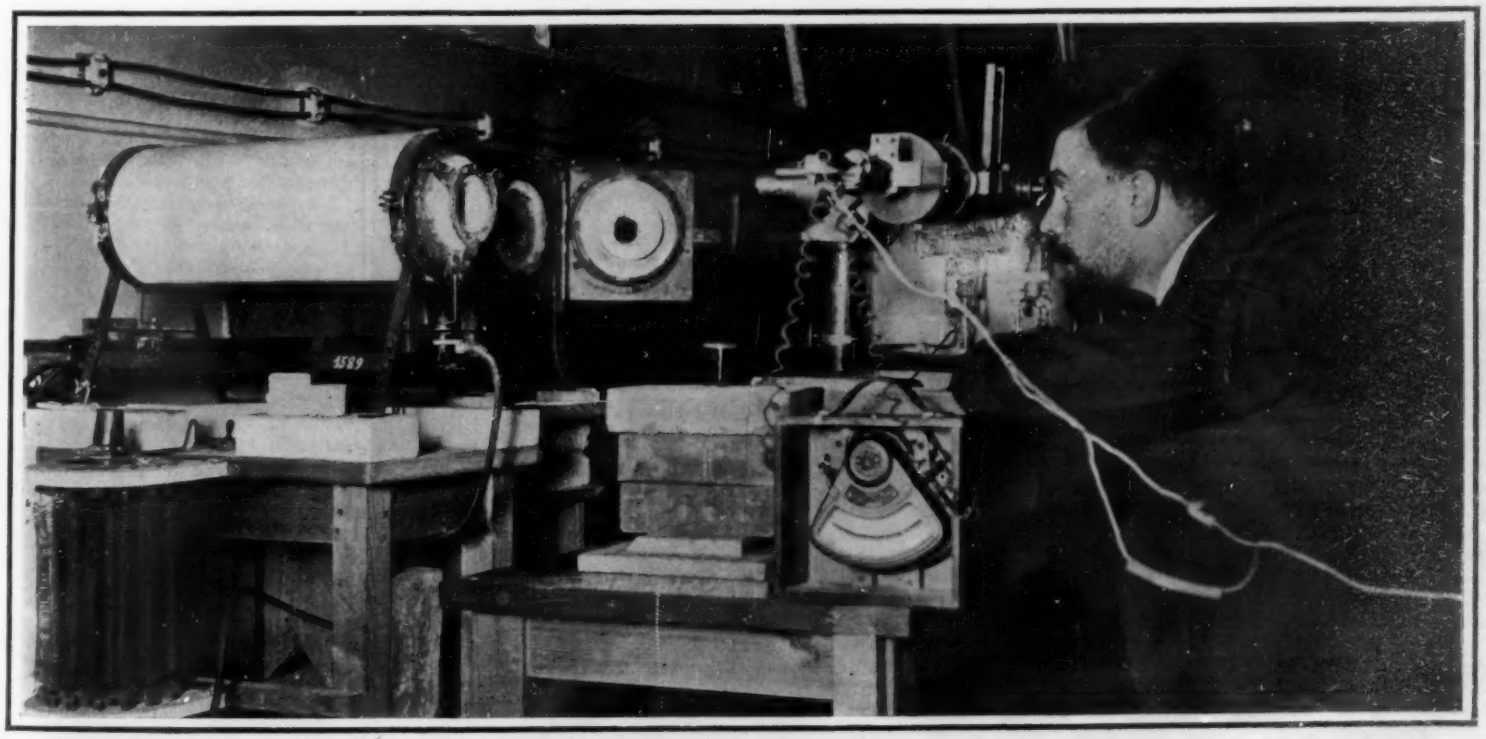
The artificial star, which performs the function of a secondary standard, is obtained by converging upon a circular aperture the light of an Osram metallic filament lamp of four volts and one ampere. This little lamp is operated by storage batteries, and regulated by means of a rheostat and an accurate voltmeter. There is no difficulty in maintaining the differences of potential between the lamp terminals constant to within 1/100 volt, by adjusting the rheostat once or twice per hour. This corresponds to an inappreciable variation in the brilliancy of the artificial star. The glass cells are filled with solutions of aniline dyes. Nordmann had no difficulty in obtaining solutions which isolate the desired portions of the spectrum. Hitherto he has employed three cells containing red, green, and blue solutions, inclosed between parallel glass walls and having a liquid thickness of 1-5 inch. The green cell transmits the part of the spectrum included between wave lengths of 590 and 490 millionths of a millimeter. The red cell transmits the part between this portion and the extreme red, and the blue cell transmits the remaining portion of the spectrum extending to the violet end.

The photometer is standardized by directing it upon the interior of an electric furnace heated to various temperatures between 2550 deg. F. and 6500 deg. F.; these temperatures being measured with the Féry pyrometer. The first determinations, made with the small horizontal equatorial of the observatory of Paris and the photometer described above, showed that this method of monochromatic images gives in a simple manner the measurements and ratios of the total luminosity of stars, free from the subjective errors inherent to the older processes. It permits furthermore the solution of certain problems of physical astronomy, especially the measurement of the temperatures of stars. The determination of temperature is oased on the fact that if the spectra of two luminous bodies are of equal intensity in their middle portion, but of very different intensity at their extremities, the body whose spectrum is brightest in the blue region possesses the higher temperature. Hence, when the two spectra are compared with flames of known temperatures, the temperatures of the stars can be easily deduced from the optical observations. Nordmann finds for the temperature of the sun the value of 5320 deg. C. (9608 deg. F.). This is

(*Continued on page 511.*)



Nordmann's heterochrome stellar photometer attached to the horizontal equatorial telescope of the Paris Observatory.



Standardizing the photometer with the aid of an electric furnace.

THE TEMPERATURE OF THE STARS.

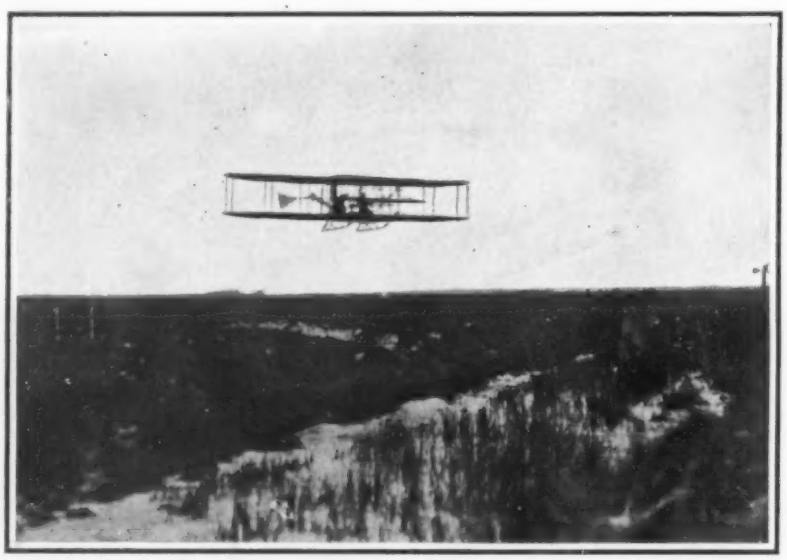
The Flights of Rolls, De Lesseps, and Curtiss Compared

BY CARL DIENSTBACH

The "heavier-than-air-machine" during the past few weeks has proved nearly as useful as the large modern airship, that has already been commercialized. When Blériot first flew across the English Channel, aeroplane traffic seemed near. But as nobody, not even his rivals in that attempt, repeated the feat, his performance gradually lost its convincing quality. In Germany his feat was dubbed a "mere piece of good luck." When, however, during the last few weeks, the Channel was not only crossed again on a Blériot machine, but in quick succession the whole navigable length of the Hudson was covered in a splendid high-speed flight, and when on the heels of that triumph the Channel was crossed and recrossed in a single flight, everyone realized that the aeroplane had entered upon a wider field of usefulness and that it was indeed a vehicle which is destined to be the pleasure conveyance of the future. The three flights mentioned were all over established routes of the liveliest traffic. They all required a machine which would not fail, under penalty of falling into the water, and they were all between rocks or precipitous mountain sides, which made it a problem to land in case of emergency, and which influenced the air currents in a way as yet so little known, that even a zephyr might become formidable. That they were successfully accomplished by machines of so widely different types as the Blériot monoplane and the Curtiss and Wright biplanes shows to what extent the technics of flying-machine construction have advanced within the past year. They especially emphasize the immense progress that has been made with regard to the heart of an aeroplane—its motor.

It seems now certain that the aeroplane motor will merely repeat the history of the automobile engine. It offers certainly a more formidable problem, but it seems now assured that the continuous failing of the early flight-motors was due less to the inherent difficulties under which they had to work—running almost continuously at top-load—than to inexperience of the makers. It should be pointed out that the Curtiss and a Blériot machine alike flew with half the power with which they were provided for these trips. They were not larger than the standard type, but De Lesseps had a 50 horse-power Gnome motor in place of the 24 horse-power Anzani with which Blériot flew across; and Curtiss also a 50 horse-power eight-cylinder motor against the usual 25 horse-power four-cylinder engine of a Curtiss biplane. Capt. Rolls had made no attempt to double the motive power of his Wright machine, but as he was flying alone he had considerable reserve force at his disposal. These were all machines capable of carrying a passenger, but flying with only the pilot aboard. Consequently the motors were not running continuously under top-load any more than automobile motors. Count de Lesseps used his power sparingly. He made little better time than Blériot. Even Curtiss, who was beating the "Twentieth Century Limited," says he rarely opened the throttle wide.

There is another feature common to these flights, to which their success must be ascribed just as much as to more reliable motive power. It is the evolution of high flying. For trips of this nature a great elevation has the very obvious advantage of easy reckoning. De Lesseps flew in a fog, yet, in contrast to Blériot, he was almost always in sight of land, at an altitude of a thousand feet, as compared with Blériot's 300. From the same superior level Curtiss saw the scenery spread below him like a chart. He could make short cuts, pick his landings, and easily decide where best to lay his course. Flying high greatly simplifies the pilot's task, where low flying would add to the difficulties of balancing, the difficulty of following a more or less circuitous course while dodging obstacles. It means something like the strain on a bicycle rider, who with his eyes glued to a country road, tries unceasingly to pick out a path. Though a flying pilot does not fear actual contact with objects below there still remains the need of allowing for leeway in case of wind gusts, irregularities of the motor or swaying the machine. The principal advantage of being able to go high is, however, in the increased "range" it gives in dominating the air itself.



Rolls in his Wright biplane making a tuning-up flight before crossing the Channel.

De Lesseps in his Blériot monoplane flying across the Channel.

THE SECOND AND THIRD AEROPLANES TO FLY ACROSS THE ENGLISH CHANNEL.

Aviators are fast realizing that it is better to escape aerial disturbances than to fight them. This tends to prevent them from following any route that approaches the confined character of a roadway. The really favorable lanes of flight may be found only if the machine, unfettered, can pick its path at any level up to a thousand feet or more. The importance of flying very high across the Channel was understood by Latham, but not by Blériot, who ran into an aerial maëlstrom while trying to land. De Lesseps and Rolls, who in landing crossed the very edge of the cliffs, many hundred feet above this trap, escaped all danger of being upset in the violent air-surf that beats against the upper part of these rocky walls not less fiercely than the surf of the sea beats against their base. As the flight of Rolls was made in considerable wind, that forced him quite some distance sideways from his intended goal, his beautiful turn in France was made possible only by these tactics. Curtiss, flying along a deep cut river valley, with a narrow base, but much wider in its higher part and surrounded by high, irregularly grouped hills, densely wooded, wisely resorted to the very opposite maneuver of skimming the surface of the water. He had no doubt learned this trick while flying above Lake Keuka. The Hudson River is known as the "American Rhine," but the long narrow valley of Lake Keuka reminds one of the German Rhine still more strongly with its long rows of vineyards along its steep sides, and the massive masonry of the wine cellars vaguely suggesting the ruins of old castles. If weather conditions are similar to those of the bright Sunday when Curtiss made his epoch-making flight to New York, the greatest safety from the air's billows is indeed found next to the water in such a river valley.

As a feat of navigation Curtiss's flight excelled De Lesseps's and Rolls's journeys across the sea. He had to deal with much more varied conditions of the air, just as changing as the topography of the landscape over which he was passing. It is not surprising that on his long trip he encountered that bugbear of the aeroplane, descending currents, that was more familiar to aviators in the old days of the Lilienthal and Chanute-Herring gliding machines when the wind was rather sought than avoided. During the past few years of the power-driven machine, for good reason the reverse condition has been sought. Gliding in a calm is so uninteresting, the machine in "dead air" seems so inert and devoid of power, that Lilienthal, Pilcher, Herring, and Avery gladly preferred to risk the gusts instead. Curtiss only reiterates what Herring fourteen years ago so eloquently described, when he refers to a feeling at the pit of the stomach like that caused by a quick-starting elevator and to lightning changes in the level of flight of twenty to forty feet.

Curtiss's ingenious use of the horizontal rudder in meeting these disturbances by a "homeopathic remedy," i. e., checking the descent by steering down and gaining speed, shows his great aptness for aeroplaning. In an interview with the author the Wright brothers indeed remarked as early as 1905, that to go up, it was at times necessary to steer down, but they did not publish such tricks of their trade. Modern aviators are rediscovering for themselves many a secret of the early "classics." Thus Mr. Curtiss is planning now to add a device which gives him a firmer hold on the machine at times, when under the impulse of descending air it is slipping faster away under him than gravity impels his own body, while in the original design of the same machine by Herring the method of handling the controls was such that the aviator could cling to it all the time just as firmly as to the first Herring glider, as adapted from Lilienthal. The method of supporting the body under the armpits was taken over in the famous Chanute glider from this adaptation and passed finally into the original design of the Herring-Curtiss aeroplane.

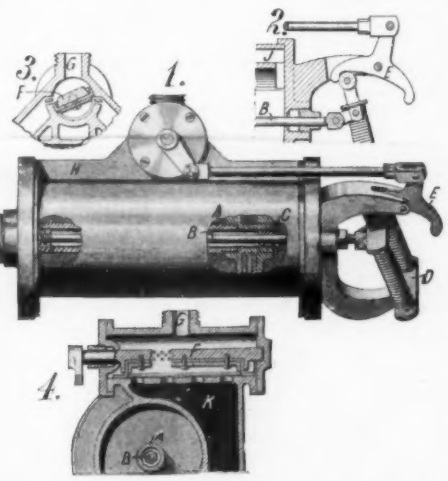
Curtiss greatly modified this design, borrowing the steering device and the running gear from the Aerial Experiment Association's machines, which he however very cleverly improved. He mounted the steering wheel on a racking upright, greatly facilitating the handling of the front control, and he designed a very simple and light, yet strong, frame for the wheels. Herring's original design may to-day be seen almost unchanged (he adopted the double front control from Curtiss) in the first Herring-Burgess aeroplanes, even as to the use of skids in place of wheels. It is certainly hardly possible to shake the aviator out of the

(*Continued on page 509.*)

Patent Department

AN IMPROVED WATER MOTOR.

Pictured in the accompanying engraving is an improved hydraulic motor of the type embodying a cylinder and reciprocating piston. The motor comprises simple means for reversing the position of the valve at the end of each stroke of the piston, so that the motor will operate continuously and automatically. Fig. 1 shows the cylinder partly broken away to show the piston and piston rod. It will be observed that the piston rod *A* is hollow to receive the valve rod *B*. The inner end of the valve rod is threaded to receive a pair of adjusting nuts, which are adapted to strike the end of the piston bore when the piston moves forward, thus forcing the valve rod outward. On the return stroke of the piston a plug *C* carried thereby strikes the nuts on the valve rod, and moves the latter to its inner position. The valve rod passes through the head of the cylinder and engages a rocker frame *D*, pivoted on a bracket formed on the cylinder head. This rocker frame consists of two crossheads connected by a pair of coil springs. The upper crosshead is formed with a roller, as shown in Fig. 2, which is adapted to engage a rocker *E*. The latter is connected by a rod and crank to a valve in the valve chest. The valve is shown in Figs. 3 and 4. It consists of a diametrically disposed plate *F*, provided with suitable packings, which may be turned to connect the inlet port *G* with either one of the passages *H* or *J*, while the other of the passages is connected with the exhaust port *K*. In operation, when the valve is turned

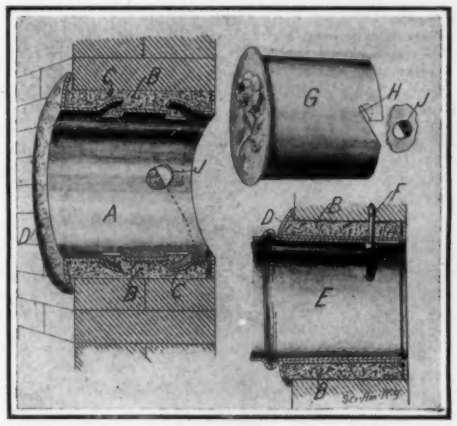


NOVEL WATER MOTOR.

to the position shown in Fig. 3, water will be admitted through the passage *H* to the left-hand side of the piston, forcing the latter toward the right and causing it, when it approaches the end of its stroke, to force the valve rod *B* outward. This will cause the rocker frame to swing out, making the roller carried thereby bear on the rocker arm *E*, and thus turn the valve *F*, so as to connect the port *J* with the inlet *G* and the passage *H* with the outlet port *K*. The springs on the rocker frame will cause the rocker arm to maintain its position until the valve rod *B* is acted upon by the plug *C* to return the parts to the position shown in Fig. 2. The inventor of this water motor is Mr John N. Hardy, of 411 West Second Avenue, Columbus Ohio.

STOVE PIPE AND THIMBLE.

A patent has just been issued on an improved type of thimble for use in flue openings. The thimble is so constructed as to be firmly attached to the chimney, and is provided with projections adapted to engage slots in the stove pipe, so as to fasten the latter securely in place, rendering the joint proof against leakage of smoke or gases of combustion. The thimble is preferably tapered, as indicated in the drawing at *A*. Between the thimble and the flue opening is a space which is filled with any suitable cement *B*, that will attach the thimble firmly to the chimney and act as a heat insulator to prevent transmission of heat from the thimble to any surrounding woodwork. The thimble is formed with projecting ears *C*, which are imbedded in the cement *B*. At each end of the thimble *A* is a flange, the inner one fitting snugly into the flue opening, while the one at the opposite end, indicated at *D*, serves to cover the flue opening and may be ornamented in any suitable manner. The stove pipe is tapered to fit the thimble *A*, and is formed with a groove *H*, adapted to receive an ear *J* that projects from the thimble. This serves to hold the stove pipe firmly in place, but the latter may be removed whenever desired by turning it before withdrawing it from the thimble. A slight modification of this fastening device consists in attaching the thimble to the chimney by means of spikes *F*, which take the place of the ears *C* as well as the ear *J*. The stove pipe is provided with tongues which are undercut, forming grooves in which the spikes are received when the pipe is given a partial turn. The

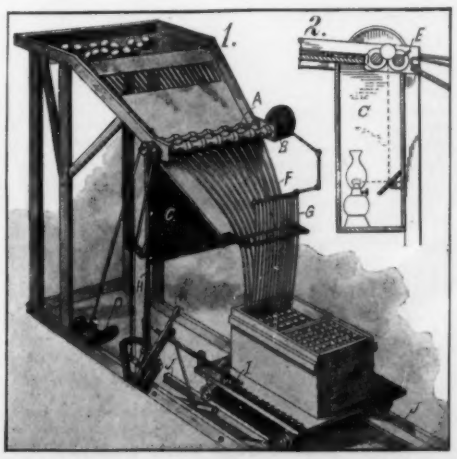


IMPROVED STOVE PIPE AND THIMBLE FOR FLUE OPENINGS.

pipe is formed with a bead adapted to engage the flange *B*, which forms a neat closure in case the pipe does not perfectly fit the thimble. When the pipe is withdrawn, the opening may be closed by means of a cap *G*, which is provided with grooves *H*, like those of the stove pipe. The inventor of this stove pipe and thimble is Mr. Ambrose P. McGuirk, of Davenport, Iowa.

EGG CANDLING AND PACKING MACHINE.

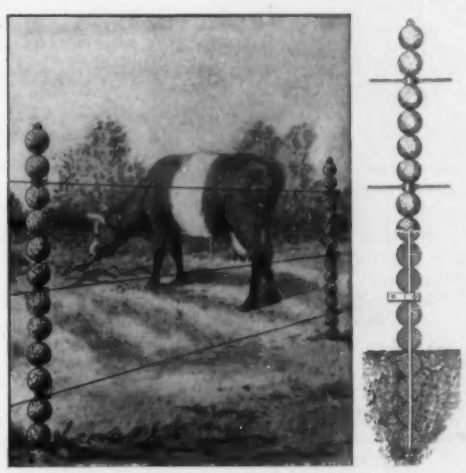
A machine for subjecting eggs to the light test, and automatically packing them in suitable receptacles, is described in a recent patent. The eggs are adapted to slide down an inclined platform to a pair of rollers *A* and *B*. A portion of the inclined platform is cut away to permit bran, straw or other packing material to drop through while the eggs pass across on a series of bridging wires. The rollers referred to are so shaped as to form sockets for the reception of the eggs, and they hold the eggs over a box *C*, in which is a lamp and a series of mirrors that direct the light upward through the eggs, so that they may be examined. The rollers are normally stationary, but may be rotated, both in the same direction, by depressing a pedal *D*. The roller *B* is provided with a number of fingers, which are adapted to lift the eggs out of the sockets formed between the rollers, and cause them to slide down the wire guides *F*. A number of retaining fingers *G* are mounted in such position as to hold the eggs at the ends of the guides *F*. The fingers *G* are connected to the roller *B*, so that they are operated to release a row of eggs at the moment that the pedal *D* is depressed, and let them drop into the egg crate. The roller *B* is connected to a pair of bell cranks, which in turn are connected by parallel rods *H*. Mounted to slide vertically on the rod *H* is a pawl *I*, which engages a rack on the carriage that supports the egg case, so that the carriage is moved forward at each operation of the pedal *D* to bring the crate into position for a new row of eggs. The carriage slides on tracks *J*, which are connected by means of a pair of links to the base of the machine in such a way that when the lever *K* is operated they may be raised or lowered to regulate the height of the crate with respect to the guides *F*. As the pawl *I* is mounted to slide on the rod *H*, it will adjust itself to the rise and fall of the carriage. Mr. Henry Pieper, of Uehling, Neb., is the inventor of this egg candling and packing machine.



MACHINE FOR CANDLING AND PACKING EGGS.

NOVEL CONCRETE FENCE POST.

A fence post of concrete blocks which is of a decidedly unique type is illustrated in the accompanying engraving. It consists of a series of blocks of concrete devoid of sharp angles and preferably of spherical form. These are mounted one above the other on a rod which extends through openings in the spheres. The post thus has the appearance of a set of huge beads strung on a giant pin. At suitable intervals a bracket is attached to the rod, to which the fence wires are secured. These brackets are of very simple form, consisting of U-shaped straps of metal, which are clamped to the rod by means of a bolt. One of the legs of the U-member is extended beyond the other, and is formed with an opening through which the fence wire is passed. Any number of these brackets may be arranged on the rod intermediate of the spheres. It is claimed for this fence post that it is particularly adapted for cattle lands because its flexibility prevents it from being knocked down, and the danger of the wires being broken is thus greatly lessened. As the blocks are spherical, they are less easily injured by frost or weather conditions. The fence post may easily be taken apart and packed in a small space for shipping. The inventor of this fence post is Mr. Charles T. Howell, of Glen Flora, Wis.



UNIQUE CONCRETE FENCE POST.

Brief Notes on New Inventions.

The presence of a submarine boat is sometimes made known to the enemy by the train of bubbles that rise to the surface of the water from the gas-engine exhaust. These bubbles are readily discernible, and indicate the course which is being pursued, thus enabling the enemy to take measures for defense or a counter attack. In order to prevent a submarine boat from betraying its course in this way, an inventor has devised a method of retaining the exhaust gases, permitting them to escape only at irregular intervals in large quantities. Although the single large gas bubble thus produced would indicate the position of the submarine, it would not give any information as to the direction in which it was traveling or its rate of speed. The exhaust gases of the engine are led to a gas purifier and cooler, and then enriched with oxygen and passed through the engine again, so that the engine works in a closed cycle. An automatic valve serves to carry out the gases, when they reach too high a pressure, and conduct them to a receptacle, whence they may be released by a hand-operated valve whenever desired.

In case of fire, so the time-honored directions run, throw a mattress out the window and then jump down on it. As a mattress may not always be handy, an inventor of this city proposes that fire companies be equipped with mattress trucks for the accommodation of those who have been trapped in a burning building. He has invented a truck provided with a platform which carries a series of bed springs and mattresses and which, when brought to the scene of the fire, may be elevated to a considerable height, say to the second-story windows, and moved inward toward the building so as to bridge over the areaway. The inmates can then leap from their windows to the mattress.

There is nothing a fireman dreads more than a fire which produces volumes of dense smoke, for it is impossible for him to get near enough to the seat of the fire and to see clearly enough to direct the stream of water properly. Various devices to enable a fireman to breathe in such conditions have been proposed from time to time. A novel scheme of this sort has just been patented. It consists of a pair of bellows connected to a water wheel in the hose near the hydrant, and operated thereby to open and close alternately. Fresh air is thus pumped through an auxiliary pipe conducted along the main hose to a mask which is worn by the fireman.

In the raising of such vegetables as asparagus, green onions, pie plant, strawberries, and the like, it

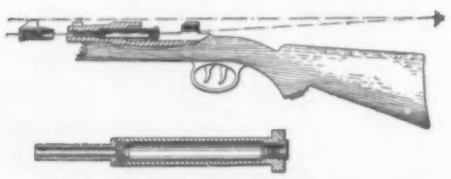
is customary to force the growth by covering the beds with glass. This is rather a cumbersome process, as it involves the construction of frames over the plants, which must be dismantled before they can be removed to a new location. Furthermore, the heating device that is sometimes employed must be moved as well, which is rather an expensive operation. An improvement on these conditions has been suggested recently. It consists in the use of a portable greenhouse and a separate portable heating plant, which may be connected to the heating pipes of the greenhouse. The greenhouse is mounted on wheels, which travel on tracks or ways. The ways are temporarily laid when moving the greenhouse from one place to another.

Two interesting patents on drinking cups have recently been issued. One of them provides a folding-pocket drinking cup, which consists of a piece of flexible waterproof material folded upon itself to form a cup without any seams through which the water may leak. The cup is covered by a strip of leather, and may be collapsed to form a flat package, so that it can be placed conveniently in the vest pocket. The other cup referred to is adapted particularly for use at soda fountains and public dispensaries of beverages. It is formed of a band of paraffine paper connected by an overlapped joint. The bottom of the cup is made out of a star-shaped blank, the points of which are folded up on the sides of the cup, and serve not only to attach the bottom to the cup, but to reinforce it. The cup is made of tapering form to permit of nesting.

Mr. Dexter M. Rogers, of Boston, Mass., has dedicated to the public an insect-destroying bomb upon which he has just secured a patent. The bomb contains dry poisons in powdered form, and is arranged to be exploded when it reaches a certain height after being discharged from a gun. The poisonous powder is thus distributed in the air, and gradually settles down on the leaves of the trees which are infected with the insects. This method of treating the trees possesses the advantage that the powder will reach all parts of the foliage, and is applied with a great saving of time and labor.

PATENTED ODDITIES.

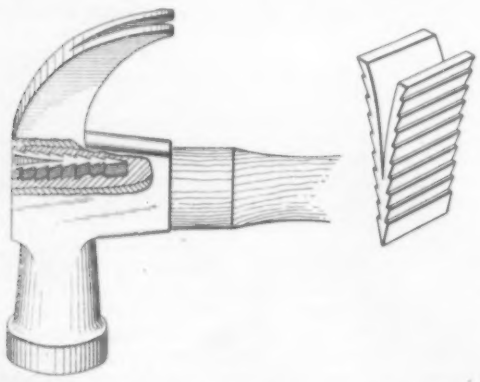
Gun-Bore Sighting Telescope.—A rather ingenious method of testing the sights of a gun has recently been patented by a German inventor. It consists in placing the telescope in the bore of the gun, with its line of



TELESCOPE FOR TESTING GUN SIGHTS.

sight parallel to the axis of the bore. The sighting device is then set to its zero position, and the gun is aimed at a distant object. The eye-piece of the telescope, which is shown in the enlarged sectional view, is fitted with a prism, so that the axis of sight intersects the line of aim at the eye. In this way it is possible to make an observation by merely moving the eye to change the direction of vision, as indicated by the broken lines, whereas heretofore it has been necessary to move the head or even the entire body, in changing from an observation along the sights to one through the telescope.

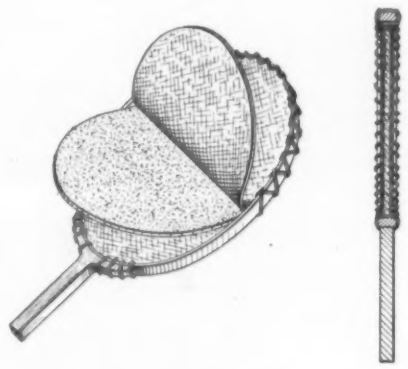
Resilient Wedge for Tool Handles.—An inventor in New Mexico has recently hit upon the ingenious scheme of using a resilient wedge for fastening the



RESILIENT WEDGE FOR FASTENING TOOL HEADS.

heads of tools upon the handles, the advantage of this being that when the wood is compressed through the use of the tool, the wedge will expand, and thus automatically tighten the handle. The wedge as illustrated herewith is split, and is provided on opposite faces with ratchet teeth that serve to prevent its withdrawal from the wood. The tool head should also be formed with ratchet teeth inclined oppositely to those of the wedge, so as to prevent the handle from being withdrawn.

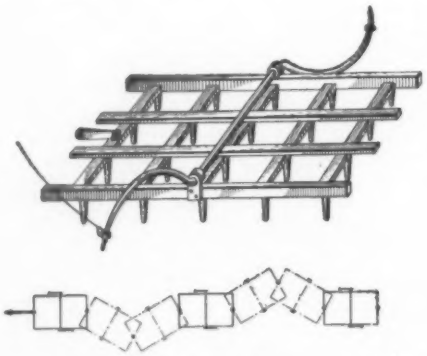
Air-Cooling Fan.—It is well known that the circulation of air increases the rate of evaporation, and thus cools a moist body. It is for this reason that we use a fan to produce an artificial draught of air over the



SELF-COOLING FAN.

face and absorb moisture from the skin. An inventor has recently hit upon the idea of improving the efficiency of the fan by providing it with a moist pad, so that the evaporation will cool the fan. The fan is made up of a rattan frame, as shown in the accompanying drawing, which is covered with two layers of cloth, between which is a layer of felt. The cloth layers may be removed to permit of taking out the felt layer to moisten it. Undoubtedly, when the fan is operated it will grow colder, by reason of the evaporation of moisture from the felt. It is a question, however, whether the added moisture in the air absorbed from the moist felt would not to a certain extent destroy its efficiency for absorbing moisture from the skin.

Device for Lifting Drags When Harrowing.—It is well known that when harrowing the ground, and during the distribution of the seed, the drags must frequently be lifted by the harrower in order to produce the desired winding or sinuous motion. The accompanying sketch illustrates a method devised by a German inventor of producing this motion automatically. Extending transversely across the drag is a rod or shaft, which at each end is provided with legs pointed at the ends. These legs are oppositely mounted so that, as the drag is drawn along, first one leg and then the other engages the ground, serving temporarily as a fulcrum about which the drag swings in an arc. As a result, the drag is caused to pursue a zigzag course across the field.

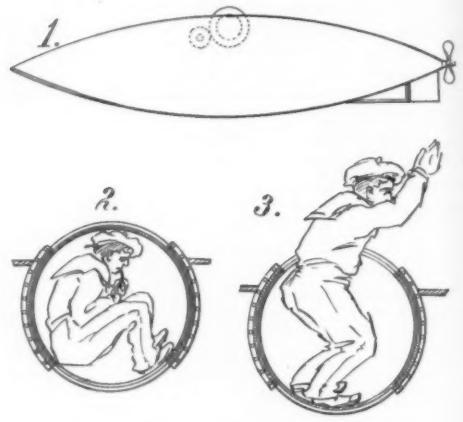


HARROW WITH AUTOMATIC LIFTER.

Stump-Splitter.—The usual method of removing stumps of trees from the ground is to split them by the use of a wedge or a blast of dynamite. The accompanying illustration shows a new method. It consists in screwing a wedge into the top of the stump. The wedge is in reality a large conical screw, provided at its lower end with a fine thread used for starting the cone into the wood. The shaft of the screw is provided with a hand wheel, by which it may be steadied and turned. Extending laterally from the shaft is a long arm, at the end of which a whiffletree is coupled. A horse may be hitched to the whiffletree, to turn the shaft and screw the cone into the stump. When the stump is too large for the threaded cone on the shaft to split effectively, another cone section may be added. After the stump has been split, by means of the cone, into a number of small parts, these parts can easily be excavated and removed.

UNIQUE HORSE-DRIVEN STUMP SPLITTER.

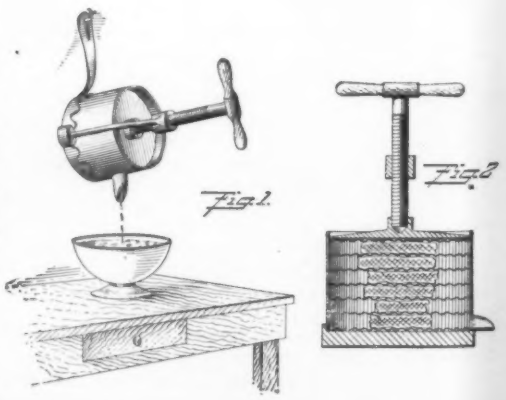
Life-Saving Hatch for Submarine Boats.—When a submarine boat has been disabled and sunk, the occupants dare not attempt to escape, for if the hatch should be opened there would be an inrush of water,



LIFE-SAVING HATCH FOR SUBMARINE BOATS.

which would drown the crew before they could escape. An inventor has recently hit upon an idea, borrowed possibly from the revolving doors that are used in public buildings, whereby the crew can escape, one at a time, without admitting more than a measured quantity of water at each operation of the hatch. In this case a cylindrical hatch is used, provided with an opening at one side. The hatch is mounted in water-tight bearings, and is connected by means of suitable gearing with a driving shaft, which will turn it on its axis, bringing the opening first into communication with the interior of the vessel, and then with the water outside. To escape from the vessel, a man crawls into the hatch, as indicated in Fig. 2, and then it is turned around to the position shown in Fig. 3, permitting him to dive upward through the water and escape.

Beef-Juice Press.—One of the best foods for invalids is the juice of rare beef, which is cut into fragments and pressed out by means of a small hand press. An inventor in France has recently devised a very simple press for this purpose, which allows of



IMPROVED BEEF-JUICE PRESS.

expressing the juice of a large amount of beef at a time. The press is similar to the ordinary type, being formed of a suitable receptacle with a plunger, which is forced down by a hand screw. Instead of operating the plunger for each piece of beef, the device is arranged to take a number of layers of beef, which are separated by disks of corrugated and perforated metal, as shown in the cross sectional view, Fig. 2. The press in provided with a spout at one side, through which the juice is drained out into a cup or bowl. After the plunger has been forced down, the press may be hung up on a nail, as indicated in Fig. 1, allowing the beef juice to drain out thoroughly.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

FASTENING FOR HEEL-CUSHIONS.—W. L. GORDON, Deal, N. J. This invention relates to pneumatic heel cushions which are adapted to be worn on the inside of the shoe at the heel for the purpose of providing a resilient cushion for the heel. The object is to provide a cushion with improved means for use in securing the cushion against moving forwardly on the shoe.

SAFETY-PIN.—W. R. DANCY and C. B. WESTCOTT, Savannah, Ga. An object of the invention is to provide a strong pin which can be released or opened by a simple manipulation which involves the use of one hand only; which is so constructed that it can be opened without grasping or handling the pin itself in any way, and which when closed is securely held against accidental opening. It is particularly useful in surgical work for pinning bandages.

Of Interest to Farmers.

CULTIVATOR PLOW.—G. W. POBANZ, Geneseo, Ill. An object of the inventor is to provide a cultivator blade or shovel which will be more readily retained in ground that is rough, hard, or overgrown with weeds, than the ordinary blade. A further object is to provide a device in which the point of the blade is so constructed that it will readily enter the ground and does not have to be resharpened like the ordinary blade.

FIRELESS BROODER.—G. H. LEE, Omaha, Neb. This invention has reference to fireless brooders such as are used by poultry brooders in raising chicks. The brooder is intended especially to be used without being heated by artificial means and the construction of the brooder is such as to retain the bodily heat which passes from the chicks.

PRESS FOR FRUIT.—T. P. MADDOX, Aztec, New Mex. This device maintains the covers of fruit crates in position to be secured to the body of the crate, and in securing the same. The packing pressure for fruit may be applied while, and in the act, of placing the cover in position. The device holds the cover in position to be secured, which device carries in convenient position a receptacle for the fastening devices for securing the cover.

Of General Interest.

CORD-RETAINER FOR PACKAGES.—M. SCHMIDT, New York, N. Y. The aim here is to so construct the package that after the cord is once tied and its ends properly protected by a knot-protector, no one can open the package without either breaking the same, mutilating the cord-protector, or cutting the cord. The device also serves to reinforce the package so that the cord may be drawn very taut without liability of crushing in the edge of the package or box.

GUN-MUFFLER.—J. H. STIMSON, Cooke, Mont. In the present patent the invention is an improvement in gun mufflers or silencers and has in view means to arrest the forward movement of the escaping powder gases and give the same a backward curling motion at successive points, whereby they escape gradually and produce a but slightly audible sound.

METAL SEAL.—S. STROH, Audrey House, Ely Place, London, E. C., England. This invention relates to metal seals adapted to be closed on cords and the like used for fastening packages. The aim is to provide a seal which shall be cheap to manufacture, which can be used without the necessity of threading the cords through holes therein and which, when secured in position, cannot be tampered with without detection.

BOOK-HOLDER.—W. C. TRAHER, London, Ontario, Canada. Mr. Traher's invention relates to book-holders, and particularly to book-holders for stenographic and other note books, a plate being provided which is pivoted to a cover of a note book, a bent wire with fingers being pivoted to the plate, and the fingers being adapted to engage and hold the covers of the book relatively to each other.

HARNESS BACK-PAD AND COLLAR-PAD.—L. P. OVERSHINER, San Diego, Cal. The pad is light yet duly flexible, and almost entirely relieves the friction between the portion resting in direct contact with the back of the animal and the portion to which the weight is applied by a strap or other means. The top plate is so arranged as to be limited in its endwise and lateral movement within certain limits. The weight is comparatively small.

COMPOUND FOR PRODUCING SILK-LIKE EFFECTS.—IA. IA. LILIENFELD, Zeltgasse 1, Vienna VIII, Austria. This invention relates to coloring matter for producing silk-like or pearl-luster effects, and such, for instance, as described in Letters Patent of the United States, formerly granted to Mr. Lilienfeld. The aim is to provide a coloring matter for effects when applied to various articles made of wood, metal, paper, leather, textile fabrics, etc.

PHOTOGRAPHIC-PRINTING DEVICE.—T. A. PATTON, Cabool, Mo. The aim here is to produce a device, adapted to be arranged in an opening through the wall of a dark room, as for instance a window, and arranged to exclude actinic rays, the device being provided with a shutter transmitting only yellow or non-actinic rays, to permit the adjustment of the sensitized paper on the negative, the shutters being arranged to be opened when the paper is in place.

HANDLE.—G. LEMIEUX, Washburn, Wis. This invention is an improvement in handles for trunks and the like, in which the handles proper are foldable, and when required for use are extended or drawn out. An angle-iron serves for the support and the reception of the handle, and strengthens and protects the angles of the same.

WATER-GUARD FOR CHIMNEYS.—W. F. GREENLEE, Atchison, Kan. In the erection of brick draft chimneys for houses, it is difficult to prevent rain water from passing down the walls of chimneys, and soiling the ceilings and side walls of rooms through which the chimneys pass. To overcome the defects, the inventor provides a peculiar construction of a water-guard in special combination with the walls of a chimney.

COMBINED CARTRIDGE-BANDOLEER, GUN-REST, SHOULDER-STRAP, AND RECOIL-PAD.—R. C. WEST, Arbuckle, Cal. In this equipment for soldiers and hunters, the bandoleer operates to retain the shoulder strap in place, and the latter serves to carry the recoil-pad and present it in proper position to receive the butt of the gun, the pad being preferably adapted to be detachably connected to either side of the strap in order that the appliance may be supported from either shoulder.

DEVICE FOR FASTENING BELTS.—G. W. SOUTHWICK, Noroton, Conn. This improvement refers to belt joints of the hinge type, having wire eyes attached to the belt ends and a pintle engaging the eyes. For the purposes of the invention use is made of guiding means for guiding a piercing tool to provide the belt with apertures for the passage of the wire used for the hinge eye, and looping means adjacent to the guiding means and around which the wire is passed to form the hinge eye.

Hardware and Tools.

HAME-TUG.—A. L. SADDLEMIRE, Knox, N. Y. The intention here is to provide a hame-tug arranged to insure a straight pull on the hame sticks and without danger of cutting or otherwise injuring the collar. For this purpose a metallic clip engages the hame stick and is provided with a transversely extending pivot on which is mounted to swing a metallic end piece of the trace.

CAN-OPENER.—J. MCD. ALLEN, St. Jo, Tex. In this case the purpose of the invention is to provide a can opener of novel, simple construction, wherein the blade is normally held near the handle but is adapted to be moved away therefrom to permit the cutting edge of the blade to be sharpened as an occasion may require.

Heating and Lighting.

PORTABLE HEATER.—S. BERGSTEIN, Youngstown, Ohio. The object of the invention is to provide a device inexpensive to manufacture, which is of convenient size to be carried in the pocket of the user, and which is provided with two lids, the latter in combination with the body forming a stand on which an object to be heated can be positioned. The device is adapted to the use of liquid fuel, such as alcohol.

GAS-MAIN STOPPER.—P. GOODMAN, New York, N. Y. This invention provides a projection in connection with the ring or eye carried by one of the handle-bars, arranged to engage the inner wall of the main at the opening and prevent the bar from pulling out of the main under the action of the locking means, the projection and eye being adjustable along the length of the handle-bar to accommodate the stopper to the point at which it is placed in the main, the eye being arranged close to the outer wall of the main when the projection is engaged.

Machines and Mechanical Devices.

PRESS-COPYING DEVICE.—H. A. BENNER, Washington, D. C. By this device clear and perfect copies may be made from type-writing made with ordinary copying ribbons and from writing made with ordinary copying inks, indelible pencils, etc., no special, heavily inked or quick-copying ribbons or inks being necessary, as in the ordinary copying devices of this type, thus obviating the smearing and blurring of letters before copying, and during the process of copying, as where quick-copying ribbons or inks are used.

BUSH-PULLER.—J. G. O'DONNELL, Washington, D. C. The present invention is an improvement in the class of machines or implements adapted for grubbing or pulling bushes. The improvement is embodied in the roller and spring attachment and in draft devices applied to the lever. The bush or sapling puller is distinguished by simplicity, lightness, ease in manipluation and effectiveness in operation.

GILL-BOX DRAWING-HEAD.—H. L. OFFERMANN, 21 Bismarckstrasse, Leipzig, Germany. In the drawing process of this invention an auxiliary hammer or cam is employed, by means of which the fallers are pressed down on to their intermediate position in such manner as to allow the withdrawal of the front row of pins from the sliver. In the construction used heretofore, owing to the limited surface on which the hammer has to work on the fallers, both are subject to much wear, so that the lowering of the fallers is uncertain, and as the hammer forms one piece with the gill screw, it has been necessary to replace it by a new screw. This disadvantage the inventor overcomes.

FIRE-ESCAPE.—J. W. THOMPSON, Hinchcliff, Miss. The object here is to provide a fire escape with a drum, a worm wheel secured to a shaft journaled in the frame, a second shaft being provided for a gear wheel, a worm, the worm engaging the worm wheel, and the gear wheel on a third shaft, which has also a bevel gear which meshes with the bevel gear on a hand wheel, by which the mechanism is operated.

VAULT-CLOSURE.—F. UNCKRICH, Galion, Ohio. The invention refers to a closure intended for locking and hermetically sealing grave vaults and the like, and consists of a door which can be locked in position at a door frame so that it cannot be opened from the outside without destroying the frame or door, and which further, can be so adjusted that if desired it can be opened from the outside without injury thereto, after it has been locked in position.

SANCTUARY-LAMP.—L. M. WILDE, North Walpole, N. H. In the present patent the invention is an improvement in sanctuary lamps and it has in view a motor-driven mechanism to trim the carbon from the lamp wick during the burning of the lamp, the said mechanism being inaudible in action and assembled compactly with the lamp proper.

TRIGGER MECHANISM.—E. R. WILLIAMS, St. Joseph, Mo. This invention refers to trigger mechanism such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Williams. The aim of the present invention is to provide certain new and useful improvements in trigger mechanisms, whereby an auxiliary can be readily set for action whenever it is desired to provide a sensitive action of the trigger mechanism.

FLUID-OPERATED CONTROLLING MECHANISM.—J. W. ANDERSON, Sisson, Cal. An important feature of the present invention involves the forming of the valve by relatively-movable parts of the supply and exhaust conduits, and another important feature involves the locating of this valve within the piston, so that the piston rod also serves as the port rod and no rod packings need be employed save a single packing at each end of the cylinder.

MACHINE FOR RECESSING SHOE PARTS.—A. H. PRENZEL, Halifax, Pa. In the device disclosed in a prior application, a slidable plate is arranged to hold a shoe bottom and to be reciprocated beneath a revolving cutter. This cutter is arranged on a horizontal axis, the blades of the cutter revolving in vertical planes. Experience has shown that in certain instances the edge of the shoe will be lifted by the first cutter, further by the second, and each succeeding will tend to pull up the edge of the bottom so that the cut which is made is not parallel to the surface of the shoe spot. An arrangement of cutter blade obviates this objection.

SHOE-MACHINE.—A. H. PRENZEL, Halifax, Pa. An object of this inventor is to provide a machine for use in recessing the heel portions of the bottom piece of shoes preparatory to affixing thereto a heel seat, and an underwedge. A further object is to provide means for adjusting the device so as to make recesses of various sizes and shapes.

PROCESS FOR MAKING SHOES.—A. H. PRENZEL, Halifax, Pa. In the present patent the invention has reference to improvements in shoes and is more particularly applicable to those shoes designed for the use of children in which a wedge is inserted under the heel seat to raise the heel while at the same time preserving the continuity of the bottom from the front to the extreme rear.

FLEXIBLE CONNECTION.—F. W. BAADEN, Newark, N. J. This invention pertains to certain improvements in flexible connection especially designed for use in connecting rotating members. The improved connection in itself constitutes a universal joint, and may be used in any form of apparatus or machinery in which universal joints are desired. It is particularly desirable for use in small flexible shafts.

TRANSMISSION-GEARING.—J. K. KOONS, Montgomery, Pa. On the transmission shaft a plurality of gears is loosely mounted and means is provided for keying the gears to the shaft in succession or for freeing all the gears; a driven shaft has a single loose gear with shiftable keying and means, a keying means in one direction secures the gear on the driver shaft while a movement in the opposite direction directly connects the transmission shaft to the driven shaft. An examination of the patent is necessary for a full appreciation of the mechanism.

Prime Movers and Their Accessories.

CARBURETER.—T. J. FAY, New York, N. Y., and J. M. ELLSWORTH, Bernardsville, N. J. One of the objects of this improvement is to provide a device adapted to automatically control the supply of charge to the engine until said engine acquires a definite predetermined speed, at which time the device automatically admits additional air and automatically increases the quantity of said air as the speed of the engine increases above the predetermined limit.

GAS-ENGINE.—C. BECKMANN, New York, N. Y. The invention comprises a compact arrangement of cylinders about a central shaft, having inclined or skew wrist pins or cranks, and by means of the cranks the reciprocating movement of the pistons is transformed into a rotary movement at the shaft. The wheel is so constructed that it operates as a valve controlling the admission and exhaust of the cylinders.

Railways and Their Accessories.

EXTENSIBLE CONNECTION.—M. E. WELLS, Massillon, Ohio. This improvement has reference to extensible connections, and admits of general use, the inventor's more particular intention being to provide a member built up of rods movable relatively to each other and provided with means for shifting the rods in order to vary their aggregate length.

MINING-CAR.—J. BLAIR, St. Benedict, Pa. The object here is to provide a car, arranged to readily withstand the rough usage and jolting of the car when in use, to maintain the axles in a right-angled position relative to the longitudinal center line of the car, with a view to insure proper running and to prevent the car being twisted out of shape when in use.

RAIL-JOINT.—W. BARNETT, Hackettstown, N. J. The object of the present invention is to so construct the bearings of the cams on the bottom flanges of the fish-plates, that a downward pressure on either the cam or the nut will not tend to slide the cam outwardly, but the said flange will operate to support the cam in operative position.

Pertaining to Recreation.

PUZZLE.—C. BRUDERLEIN, New York, N. Y. This device comprises an elongated box having an elevated runway along which small balls or shot may be guided from one end to the other. At one end a plurality of pockets are provided which may receive the balls, and in addition special means provide for returning the balls to the end remote from the pockets, and for bringing them into position for advancing them into the pockets.

GAME.—J. R. NIXON, New Orleans, La. The purpose of Mr. Nixon's invention is to provide an amusing and instructive game wherein a field having hazards is provided, and a balanced lever, to one end of which is connected figures adapted to be moved into view when the lever is rocked by the weight of other figures movable over the field.

Pertaining to Vehicles.

ADJUSTABLE PATTERN FOR TONGUE-HOUNDS.—N. J. SMITH, Halstead, Kan. In this instance the invention relates to certain improvements in patterns for use in the manufacture of tongue hounds for wagons, and the aim is to provide a pattern so constructed as to permit of its use in marking out hounds of various different shapes and forms.

WIND-SHIELD.—E. J. MONTIGNY, New York, N. Y. This improvement relates to wind shields for use in connection with automobiles and other rapidly moving vehicles, the more particular purpose being to provide a wind shield comprising a two-part sash adapted to fold neatly into the dash board which is of special structure in order to receive the shield.

WAGON-SEAT FASTENER.—IA. M. LATTIMORE, Shubert, Neb. This invention is embodied in devices adapted to support and clamp a seat detachably upon the sides of a wagon body. In order to detach the seat from, or adjust it on, the body, it is necessary to first turn the roller to bring its cam out of contact with, or away from, the wagon side. In order to adapt the roller to a firm hold on the wagon side, the cam or eccentric portion thereof is provided with obtuse angled grooves.

BUGGY-SHAFT TUG.—W. G. PETREE, Danbury, N. C. The improvement is in buggy shaft tugs and the purpose of the inventor is to provide a device of this character which will obviate the necessity of slipping the tug over the end of the shaft, and wherein the shaft will automatically enter and lock the tug when it is lowered into place.

VEHICLE TRACTION MECHANISM.—J. L. WILLIAMS, Ellzey, Fla. The principal objects which the present invention has in view are: to provide a mechanism wherein the traction is obtained through members which are positive in their engagement with the ground; to provide a mechanism adapted to operate in broken and unequal ground, and to provide a driving mechanism simple, elastic and durable.

VEHICLE-WHEEL.—J. W. CARHART, Austin, Texas. In this patent the tire comprises a series of laminæ arranged side by side and provided with openings for dowel pins passing through the openings. A ring plate is arranged on each side of the tire and against its inward face the adjacent ends of the pins abut, bolts traversing the plates for securing them in place, and an elastic envelope on the outer face of the tire and lapped on the side thereof, the edges of the envelope abutting the edges of the plates, and nails driven through the envelop into the laminated body of the tire.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

The full name and address must accompany all letters, or no attention will be paid thereto. This is solely for our information. *All* queries are answered by mail, and a *few* of the selected answers are afterward published in the paper. We cannot undertake to furnish information on matters of personal interest, without reasonable compensation. To answer questions which are not of general interest usually costs us from $2.00 to $5.00 each upward, and this sum should invariably be remitted in such cases. When there are questions involving building or other construction, or when calculations must be made, an estimate of the cost will be furnished upon request. We cannot give answers to examination papers, or decide wagers, nor can we undertake to solve mathematical problems of any description whatsoever. Do not use postal cards. Do not telephone inquiries, we cannot do justice to them.

Queries from this vicinity not answered within fourteen days should be repeated in full. Queries from points more remote will require a longer time.

We do not make chemical analyses; but we are always pleased to give the names of minerals which are submitted to us, when it is possible for us to do so. The minerals should be sent marked distinctly with the name of the sender, and should be sent fully prepaid.

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Any books on any scientific or technical subject can be furnished. We solicit requests for quotations. The SCIENTIFIC AMERICAN SUPPLEMENTS referred to are mailed for ten cents each. Book and SUPPLEMENT catalogues will be sent free on request. A careful reading of these "Hints to Correspondents" will prevent any misconception as to the uses and will prevent abuses of this column.

(12242) J. C. G. says: If the world was perfectly round and smooth, and a belt was fitted around the center, perfectly tight, without a fraction of slack, and the belt when thus fitted was exactly 25,000 miles long, and this same belt was lengthened 18 feet, how much would this belt, after being thus lengthened, stand out from the earth's surface, supposing that the earth was exactly in the center of the belt? I have a bet with some men that the belt will not stand out from the surface 2.96/100 feet at all places, and to convince them I am right, I have been referred to you as authority. They argue that the diameter of the belt after being lengthened will be six feet more than when measuring 25,000 miles. It is absurd, I think, but at the same time I would be glad to know the fraction it would be supposed to leave the surface. A. We make it a rule not to settle bets, but as this is a simple statement of fact, and the result of the bet depends not at all upon our judgment, which can be proved to you by anyone with a sufficient knowledge of simple arithmetic and the value of π (the relation between the diameter of a circle and its circumference) and as you would doubtless obtain a decision elsewhere, we do not like to seem discourteous by refusing to answer your question. The only consolation we can give you is that it was not a fair bet, as your opponents were betting on a certainty. Incredible as it may seem that the addition of so trifling an amount as 18 feet to a belt 25,000 miles long should increase its diameter nearly three feet, such is undoubtedly the case. It is figured as follows, and there is no way of figuring it otherwise: A more accurate value of π, say to ten instead of five places of decimals, would reduce the amount by an insignificant trifle. The difference of 0.14 between our result and that of your opponents is easily explained by their having used a different approximation of the value of π. The circumference 25,000 miles of the belt you suppose $\pi = d = 3.14159\ d$, therefore the assumed diameter of the globe

$$\text{would be } \frac{25{,}000}{3.14159} \text{ miles } = \frac{132{,}000{,}000}{3.14159}$$

feet = 41,422,920 feet. The diameter of the belt when its circumference is lengthened by 18 feet is $\frac{132{,}000{,}018}{3.14159}$ feet = 41,422,925.64,858 feet. The diameter is therefore increased in length by the difference = 5.64,858 feet, and the lengthened belt will stand off from the globe by half that amount or 2.82,429, etc., feet.

(12243) K. A. R. asks: Will you explain through the columns of your paper the following? A person said to me that the earth makes a complete "wobble" once every 25,800 years; i. e., the North Pole changes its position in relation with the stars, and consequently another star is designated the North Star. When asked what caused this wobble, he replied that it was similar to the wobbling of a top whose energy is nearly spent. The point that I do not understand is this: In the case of the top, after its rotation has decreased to a certain extent, the attraction of gravity overcomes the gyroscopic force and therefore causes the top to wobble; but in the case of the earth, there is no attraction other than that of the other heavenly bodies which is practically equal in all directions. Therefore why should the earth wobble? and is the rapidity of the rotation of the earth decreasing? A. The subject about which you inquire is called in the astronomies "the precession of the equinoxes." Any astronomy which may be in the library of your city will give you all the information you require on this matter. The poles of the heavens *move*, not *wobble*, around the poles of the ecliptic in a vast period of 25,000 years. This causes the North Pole to move away from the Pole Star of our times, till in 12,500 years it will be 47 degrees away from it. Alpha Lyrae will then be the Pole Star. Precession is due to the attraction of the sun and the moon upon the ring of earth around the equator, as they are alternately on one side and on the other side of the ring. The attractive force of the sun and moon is combined with the centrifugal force of rotation of the earth to produce this extremely long period of precession. If you are not able to find any satisfactory work in your public library we can send you Todd's "New Astronomy" for $1.50. The motion of precession is very like that of the spinning top when its axis is slightly out of plumb.

NEW BOOKS, ETC.

MODERN COKING PRACTICE. By T. H. Byrom and J. E. Christopher. London: Crosby Lockwood & Son. New York: The Norman W. Henley Publishing Company, 1910. 8vo.; 168 pp. Price, $3.50 net.

The subject of coke manufacture is of rapidly increasing interest and significance, embracing as it does the recovery of valuable by-products in which scientific control is of the first importance. It has been the aim of the authors, in compiling this book, to produce one which shall be of use and benefit to those who are associated with, or interested in, the modern developments of the industry. While the book embodies, with some amplifications, a series of lectures delivered by J. E. Christopher, at the Wigan Technical College, to a class of men engaged on coke ovens, the authors entertain the hope that the work will be appreciated by students generally, and by many who are engaged in coke manufacture, or who contemplate the laying down of a by-product plant. Every endeavor has been made to present the facts as completely up to date as possible, and if excuse be necessary for the production of such a book, it is that in proportion to the importance of the subject the literature relating thereto is very scanty, and the authors feel that they are not adding to an already overburdened subject. I

DIAGRAMS FOR DESIGNING REINFORCED CONCRETE STRUCTURES, Including Diagrams for Reactions and Strengths of Steel Beams. By G. F. Dodge. New York and Chicago: The Myron C. Clark Publishing Company, 1910. Oblong, 13 x 16 inches. 104 pp. Price, $4.

The author, like many other engineers designing in reinforced concrete, has often wished for some method of reducing the tedious detail calculations resulting from the diverse properties of the materials being used. Many methods have been and are in use at present, but all of these, whether in tabular or diagrammatic form, are based on more or less inflexible approximate formulae which introduce quite considerable errors if the proportions of the composite structure vary materially from those assumed in deriving the formula on which the method is based. A method to be universally acceptable must be based on theoretical formulæ and embody all of the requirements that occur in the building ordinances that govern construction in the various localities. It must be rapid and accurate in its applications, and if possible give at a glance the final result of changing any one or more of the assumed variables of design.

ATKINSON'S SIGN PAINTING UP TO NOW. By Frank H. Atkinson. Chicago: Frederick J. Drake & Co., 1910. Oblong 4to.; 378 pp. Price, $3.

This is a very handsome book on sign painting and the design of show cards with valuable alphabets, which contains 96 designs of lay-outs and accompanying color notes. There are 75 alphabets embracing all standard styles, their modifications and alterations, together with comprehensive text covering all practical phases of the art. There are a number of illustrations in the first part of the book showing how the work is actually done. These are specially valuable and we have not the same in any other book. The work seems to be eminently practical and the technical matter reflects the best usage in vogue at the present day.

THE LIFE OF WILLIAM THOMSON, BARON KELVIN OF LARGS. By Silvanus P. Thompson. Two volumes. New York and London: The Macmillan Company, 1910. 8vo.; 1,297 pp. Price, $7.50 net.

One would naturally expect that a biography of Lord Kelvin, written by a prominent physicist, such as Silvanus P. Thompson, would deal largely with the scientific accomplishments rather than the personal life of the subject; and this is, in a measure, true. A picture of Lord Kelvin's life and home relations has already been written by his own sister. The present volumes, however, take up the life of this great man from a different viewpoint, that is, in relation to his epichal work in the realms of science. The present biography was begun nearly two years before the death of Lord Kelvin. Hence it was possible to obtain much valuable information and many personal reminiscences, which give the volume some of the importance of an autobiography, while at the same time due prominence is given to certain matters which might have been modestly passed over had Lord Kelvin been writing his own life story. The biography is made up to a large extent of manuscripts and scientific correspondence, and the author has wisely avoided placing his own interpretation upon them, preferring to let them speak for themselves. The work is intensely interesting from cover to cover, despite the fact that the work of Lord Kelvin was far in advance of the majority of his fellow men. The reader is brought into intimate association with the young man who struggled to the foreground in his college days, who in his very earliest days as a scientist did much to bring the theories of Joule into prominence, who as the foremost electrician in his time was the master mind in the problem of bridging the Atlantic Ocean by cable, and whose later work in the study of tides, mathematical astronomy, physics and electricity carried him far above any other man of his times. The two volumes are handsomely bound, and should make a most important and attractive addition to the library of the layman as well as the technical man.

MODERN ASSAYING. By J. Reginald Smith. Edited by F. W. Braun. Philadelphia, 1910. 16mo.; 145 pp. Price, $1.50.

The present book is not intended to be an exhaustive exposition of the subject, nor to take the place of the many excellent works on assaying, but rather to present in a concise, intelligible, untechnical way the science and methods for the assay of precious metals so that the reader may in the shortest possible time acquire the necessary knowledge to enable him to follow out practical work. They who have mastered the first ground work will soon gain all the rudiments of the science and use of the apparatus. The Editor has the advantage of being in the business of supplying assay and chemical laboratories. There are too many books on chemistry and assaying which are written by theorists. The book is admirably illustrated and may be considered as an excellent contribution to the subject.

THE WIRELESS TELEPHONE. By H. Gernsback. New York: Modern Electrics Publication, 1910. 12mo; 78 pp., 52 illustrations.

The object of this book is to review what little is known of wireless telephony, and induce amateurs to investigate this interesting application of Hertzian wave communication. The author, who is the editor of Modern Electrics, is quite optimistic of the part that wireless telephony is to play in the immediate future. Very little of a practical nature is contained in the book, for the reason that the art is yet in its infancy. The amateur is not told how to establish a wireless telephone system, but is merely informed of the efforts of others, which can hardly as yet be said to have reached the practical stage.

MODERN CABINET WORK, FURNITURE AND FITMENTS. By Percy A. Wells and John Hooper. London: B. T. Batsford. New York: John Lane Company, 1910. 4to.; 384 pp. Price, $5 net, postage 50 cents.

This is an account of the theory and practice in the production of all kinds of cabinet work and furniture, with chapters on the growth and progress of design and construction. It is illustrated by over 1,000 practical workshop drawings, photographs, and original designs. The book is particularly well made and the illustrations are of satisfactory size. There are many half-tones included in the text, showing exactly how the work is done. We have often wondered why it was that no one had gotten up a book showing how to use the hands in cabinet making, which is a most interesting trade or amusement, depending on whether the person is a professional cabinet maker or an amateur. Wood-working in England has a vogue among amateurs which is entirely wanting in this country. This is probably owing to the fact that they lack proper instruction. This book will give them exactly the information which they are seeking. Among its many good points is a chronological chart giving names, periods, dates, general characteristics and proportions of chairs and seats in various styles. The whole book bears the impress of careful work, and there is little question but that it will have a considerable sale in this country among amateurs. There is also an excellent glossary.

"FLIGHT" MANUAL. A REFERENCE BOOK OF NOTES, FORMULAE, AND TABLES. By Algernon E. Berriman. London: Published by "Flight," 1910. 16mo.; pocketbook size. Price, $4.20.

Two main objects associate with this book: one is to form a nucleus of what is hoped will become the standard work of reference on flight and aeronautics; the other is to provide a key to the articles appearing in the weekly periodical "Flight" whereby new readers may be enabled to pick up the subject with facility. Naturally the most important sections of the book are those dealing with fliers, gliders, balloons, airships, and other subjects directly connected with aero-dynamics and aero-statics, but since the fundamental laws governing the behavior of flying machines are essentially the same as those underlying other physical phenomena, a large part of the contents has been devoted to data of a general character. In fact, a special effort has been made to compile such a really comprehensive set of tables and formulæ that this manual contains all the references necessary for quantitative calculations; it is further hoped that, on this account, it may prove of utility in all branches of engineering and general science. The book is an admirable one and is filled with tables which are very necessary to those engaged in all kinds of aeronautical experimentation.

GLIMPSES AROUND THE WORLD THROUGH THE EYES OF A YOUNG AMERICAN. By Grace Maxine Stein. Philadelphia: The John C. Winston Company, 1909. Illustrated. 8vo.; 481 pp. Price, $2.

Of books of travel there seems to be no end, and every book seems to have more or less of a field of its own. The volume before us is very readable and profusely illustrated with engravings, the originals of which seem to have been selected with rather more than the usual care. The book is printed in large type on good paper and is worthy of an excellent sale.

APPLIED MECHANICS. By David Allen Low, Whitworth Scholar, M.I., Mech. E., Professor of Engineering, East London College, University of London. London, New York, Bombay, and Calcutta: Longmans, Green & Co., 1909. 551 pp., 850 illustrations. Price, $2.75 net.

Mr. Low has succeeded in crowding a great deal of matter between the covers of this text book for engineering students. It embraces strength and elasticity of materials, the theory and design of structures, the theory of mechanics, and hydraulics. The matter is presented in a very clear and concise manner. The author believes thoroughly in the importance of exercises to fix a subject upon the student's mind. Accordingly a large part of the book is devoted to various exercises, there being 780 in all, 600 of which are original. The remainder have been selected from various examination papers. The book should occupy an important place in the student's library.

DESCRIPTIVE METEOROLOGY. By Willis L. Moore, LL.D., Sc.D. New York and London: D. Appleton & Co., 1910. 8vo.; 344 pp.; 45 charts and 81 illustrations. Price, $3 net.

The author's present office as chief of the United States Weather Bureau, as well as his thirty odd years of experience in this connection, give the present work the stamp of authority. The purpose of the book is to instruct young men entering the service of the United States Weather Bureau, who have been hampered in the past by not having up-to-date text books on the rapidly progressing science of meteorology. However, the book has been written in such style as to appeal to the layman as well as the student. Technical terms have been carefully explained, for it is assumed that the reader knows little or nothing about the subject. Certainly every one is interested in the weather, and should welcome an opportunity such as this of making himself acquainted with the laws which govern the movements of storms. A chapter has been devoted to weather changes, which should enable the layman to make a good forecast with the aid of the daily official weather map. The study of meteorology is taken up in its broadest sense, with reference not only to the lowermost strata which directly concerns us, but to the entire depth of the earth's atmosphere, the latest study of the upper layers by means of sounding balloons and the part that is played by the sun and the motion of this planet about it.

THE STUDENT'S MATRICULATION GEOMETRY. Books 1-4. By Saradakanta Gangopadhyaya, M.A. Calcutta: The Students' Library. 12mo.; 348 pp.

This book has been written in strict conformity with the syllabus prescribed by the Calcutta University for the matriculation examination. A second edition of this book has just been issued, the first having been very well received by the teaching public.

CONIC SECTIONS MADE EASY. By Saradakanta Gangopadhyaya. Calcutta: Students' Library, 1909. 97 pp.

The author has written this book with a view to meeting the requirements of candidates for the intermediate examination of the Calcutta University. He attempts to remove difficulties which the geometry of conics has been found to present to the student.

THE HEALTH OF THE CITY. By Hollis Godfrey. Boston and New York: Houghton Mifflin Company, 1910. 12mo.; 372 pp. Price, $1.25 net.

Like all books issued from the Riverside Press, it has a certain air of distinction gained only by great simplicity in typography. Few contemporary topics are so pressing, or attracting so much attention, as city sanitation to help the health of cities. Mr. Godfrey, well known for his work in popular science, has been making a study of these questions for many years, and has come to be an authority in the field. This book brings together the results of his studies. The topics treated are: City Air, Water, Milk, Food, City Ice, Noise, Waste, Plumbing, City Housing. A book of intense interest to every intelligent citizen.

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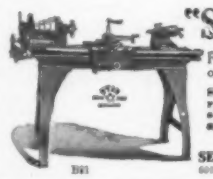

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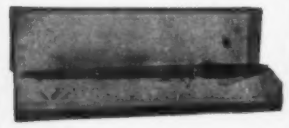

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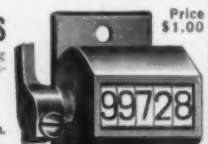

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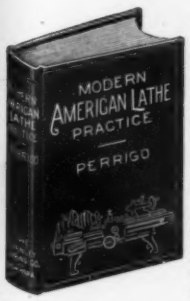

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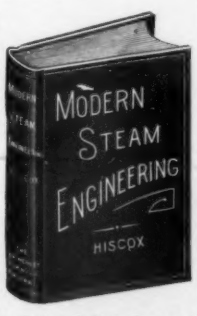

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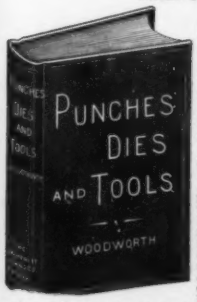

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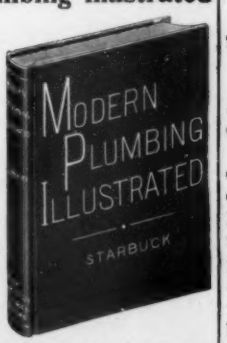

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A TELEPHONIC STETHOSCOPE.

(*Concluded from page 496.*)

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THE FLIGHTS OF ROLLS, DE LESSEPS AND CURTISS COMPARED.

(*Continued from page 502.*)

seat of one of these machines under any conditions.

De Lesseps used a 1910 Blériot for his channel flight. This model is not greatly changed from the machine that carried Blériot across to England. It is somewhat stronger in the framing and the power of the tail has been increased by enlarging both the stabilizing and the rudder surface, and by placing the stabilizer at the same level with the rudder. Even the vertical rudder is slightly larger.

Rolls is said to have flown in a French-built Wright machine. As he used a Short-

(*Continued on page 510.*)

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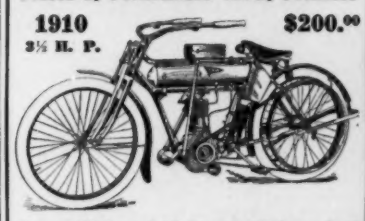

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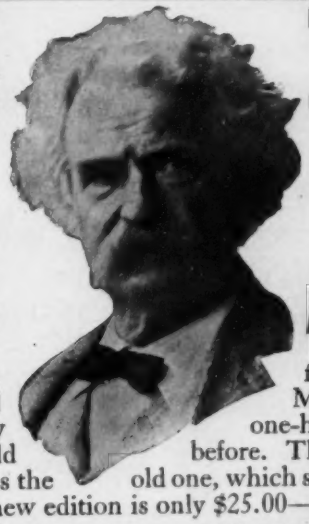

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Inquiry No. 9168.—Wanted, the name of manufacturer making the Morse Eureka Spring Terminal, sometimes called spring clip.

(Continued from page 509.)

Wright biplane before, it is safe to surmise that his cross-channel flyer was one of the new, powerful French Wrights, with a double horizontal rudder (a surface in the rear added, which as in the Farman machines, acts in unison with the front rudder). This is in accord with the Wrights' tendency to increase the power of the controls to the highest possible pitch, and at the same time it acts somewhat like an automatic steadying device. Any surface in the rear tends to steady.

In practical results Curtiss's flight may be said to have been the most fruitful of the three. This is due to its entirely unprecedented sustained speed over such a long distance. The most important feature that Curtiss added to the Herring-Curtiss type was his 8-cylinder motor. In doing this he only repeated what he before had done with his bicycles, when he designed the strong 2-cylinder V type. A motor bicycle one cylinder is sufficient for all practical purposes, but with two cylinders the machine is vastly superior in many ways. Mr. Hamilton, for instance, could hardly start his machine single handed by cranking his motor with the throttle almost closed, if he had only four cylinders, just as it is so hard to run a one cylinder motor cycle slowly and still regularly.

What Curtiss's speed flight means is simply this: that even while the aeroplane is still dependent on calm weather, it is an entirely practical means of peaceful traffic and a most formidable engine of war, for the simple reason that a short period of calm is rarely difficult to find, but that during such a period a Curtiss machine with its capacity for very high, sustained speed, may render services of the greatest practical usefulness. To many a business man it might be highly desirable if he could cover a distance like that from New York to Albany, between places where there is no direct railroad connection, with a speed exceeding that of the fastest express train, with comparatively slight expense and whenever half a day's calm weather can be counted upon. In war, the Curtiss type of machine may become a decisive factor in spite of its comparatively small carrying capacity.

Calm weather may be dreaded like the plague by the commanders-in-chief of future campaigns. The small, speedy Curtiss machines may be as immune from attacks from the ground as mosquitoes in the air. They may not only scent but also paralyze operations, not by throwing dynamite (their small supply would be exhausted before any great damage was done), but by setting things afire with the smallest quantities of burning chemicals—a modern revival of the Greek fire. These machines cannot be kept out of any part of the country they may choose to lay waste to. All this emphasizes how each step ahead in the conquest of the air demonstrates all the more clearly the dependence of the air pilot on the highest development of meteorological science.

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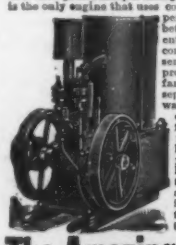

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THE TEMPERATURE OF THE STARS.

(*Continued from page 501.*)

much higher than the temperature of the electric arc (3600 deg. C., or 6512 deg. F.) and agrees very well with the values obtained for the temperature of the sun, by actinometric or pyrheliometric methods, by Wilson (5773 deg. C., or 10.403 deg. F.) Scheiner (6200 deg. C., or 11,192 deg. F.), and Féry and Millochau (5360 deg. C. or 9680 deg. F.).

The following table contains some of Nordmann's determinations of the temperatures of stars:

NAME OF STAR.	TEMPERATURE. DEG C.	DEG. F.
Rho Persei	2870	5200
Zeta Cephei	4260	7700
Gamma Cygni	5620	10150
Chi Herculis	7350	13250
Polaris	8200	14800
Alpha Lyrae	12200	22000
Beta Persei	13300	24000
Gamma Lyrae	14500	26100
Epsilon Persei	15200	27400
Delta Persei	18500	33300
Lambda Tauri	40000	72000

Independently of these thermal measurements, Nordmann's method, in conjunction with the spectral analysis of stars, gives information concerning their comparative stages of development. These very high temperatures explain the fact that in some of the stars the spectroscope reveals the existence only of elements like hydrogen, nitrogen and carbon, and the compound of carbon and nitrogen called cyanogen, which is indissociable by heat.

Nordmann's apparatus also opens many new prospects in photometry, a science which is still in its infancy, except as regards the sun, although the exact measurement of stellar radiations, like that of stellar positions, is an indispensable prerequisite to the knowledge of the constitution of the stellar universe.

The observations made at Harvard University and at Potsdam, Germany, in connection with the publication of the great photometric star catalogues, have begun to blaze the path, which astronomers have thought less difficult to follow than it really is. In determining stellar magnitudes, the American and German observers merely measured with the photometer the total luminosity of each star; but, as the stars are of different colors, the values thus obtained are affected by errors of physiological origin. Furthermore, it has long been known that estimations of the brightness of variable stars, especially red stars, exhibit great individual differences. A comparison of the catalogues of Harvard and Potsdam shows differences in the recorded brightness of red stars. If in one catalogue the ratio of the brightness of a red star to that of a white star is represented by E. it will be represented in the other catalogue by 3/2E. These systematic differences appear to be due to two distinct causes. The first source of error is purely physiological and consists in the fact that sensations of color are produced by the excitation of the terminal filaments of the optic nerve, which line the retina, and which are of three different sorts, sensitive respectively, and almost exclusively, to rays of the red, the green, and the blue and violet portions of the spectrum. Now this relative sensitiveness varies greatly in different individuals, as is strikingly illustrated by the extreme and pathological case of Daltonism, or color blindness. The luminous sensation produced by a given star, that is to say, the aggregate effect, impressed upon the filaments of the three different kinds, differs in different individuals. The second cause of error is found, apparently, in the phenomenon discovered by Purkinje, which may be expressed as follows: If two sources of light, one blue and the other red, appear equally bright to the eye, and if the brightness of each source is then diminished in the same proportion, the red light will appear less bright than the blue. The result is that, for the same observer, the estimation of the color of a star depends, other things being equal, upon the magnitude of the star and the aperture of the telescope. Additional complications are introduced by the age of the astronomer, the position of his eye in respect to the eye piece, the degree of ocular fatigue, etc. Fortunately, Nordmann's photometric method eliminates these errors in the determination of the total luminosity of stars. It makes possible an exact study of the colors of stars and of the dispersion of light in interstaller space. Finally, it will undoubtedly give information concerning the intrinsic mechanism of the strange and mysterious transformations of variable stars of all classes.

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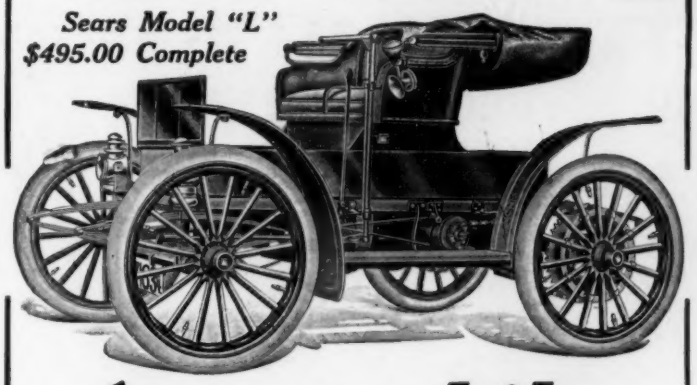

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A Storm-Warning Service for Aeronauts.

Dr. Franz Linke, director of the Meteorological Institute of the Physikalischer Verein at Frankfort-on-the-Main, has published a report on the special storm-warning service that he organized last summer in connection with the International Aeronautical Exposition. This service, being the first of its kind, was experimental; but proved so successful that a similar undertaking is likely to be a feature of all future aeronautical competitions on a large scale, especially if held in a region of frequent thunderstorms.

The prediction of large general storms can be safely left to the national weather services that now exist in all civilized countries. Local storms, however, and especially thunderstorms, are notoriously difficult to forecast on the basis of the widely scattered reports that make up the ordinary weather-map and that are all that the forecaster ordinarily has at his command. The attention of the Frankfort service was directed especially to the prediction of thunderstorms. The life-history of these storms is now well understood, thanks to the brilliant investigations of a small group of meteorologists of whom M. Durand-Gréville is the most conspicuous. In the great majority of cases they sweep across the country in a long line that may be compared to the front of an advancing army—the "thunderstorm front"—at a speed averaging, in Europe, about 40 kilometers an hour. The line of advance keeps a position more or less parallel to itself, and its progress is not difficult to predict, if its existence and position are known at any given time. The prerequisites of successful thunderstorm prediction are a dense network of reporting stations and a system of adequate telegraphic communication with the central station.

Dr. Linke engaged the services of fifty-five observers, constituting a picket-line of 150 kilometers radius around the city of Frankfort. These were mainly recruited from among the volunteer observers already reporting, but not by telegraph, to the existing meteorological institutes of Southern Germany. These persons were requested to send an "urgent" telegram to Frankfort whenever a thunderstorm or a wind-squall (which is first-cousin to the thunderstorm) appeared in their vicinity, between the hours of 7 A. M. and 7 P. M. The compensation offered was a free entrance ticket to the exposition and a copy of the published results of the experiment.

The result of these arrangements was most gratifying, as, with one or two exceptions, all the thirty-seven thunderstorms that reached Frankfort during the three months of the exposition were duly heralded an hour or more before their arrival.

It is noted that no air-craft attempted to fly in the face of providence—and the weather forecaster—except the big "Zeppelin," which began its famous voyage to Cologne against the advice of the forecaster and promptly ran into a heavy thunderstorm.

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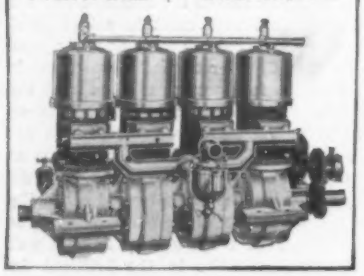

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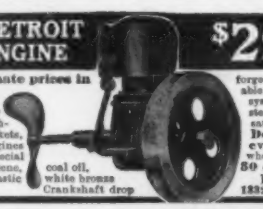

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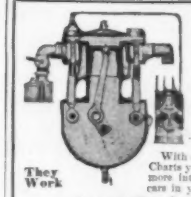

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